PENNSYLVANIA TURNPIKE SYSTEM
PHILADELPHIA EXTENSION

DEDICATION ISSUE OF
HIGHWAY BUILDER

DAVID R. PERRY

HIGHWAY BUILDER

THE PENNSYLVANIA TURNPIKE SYSTEM

Philadelphia Extension Dedication Issue

OCTOBER 1950

MEL GEMMILL

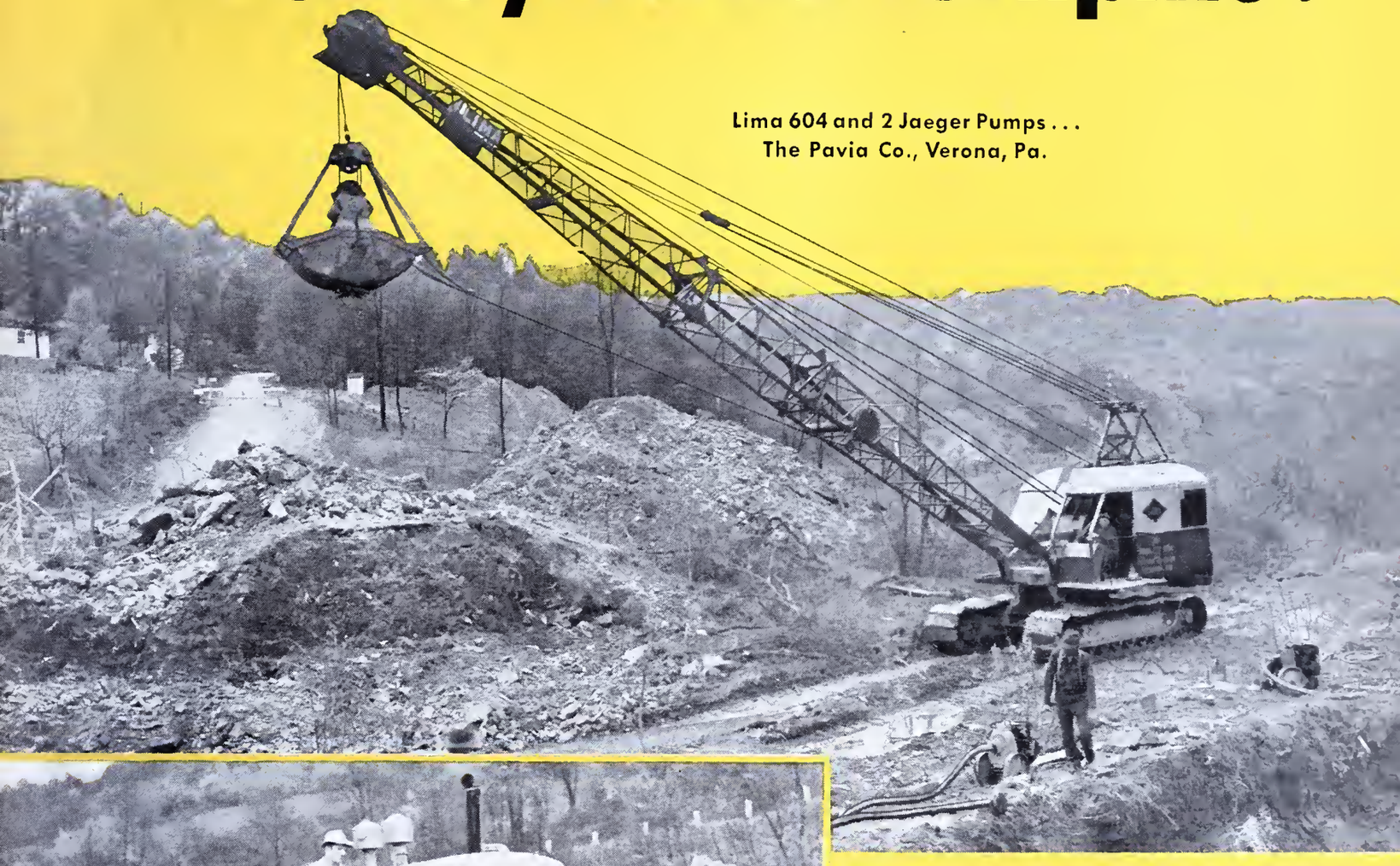
HIGHWAY EQUIPMENT

12 years ago, when work started on the Pennsylvania Turnpike, successful bidders used Highway Equipment to speed up their jobs and keep costs well within estimates. And again in 1950—leading contractors have relied on Highway for shovels, tractors, dozers, compressors, pumps...every type of equipment needed to complete one of the world's biggest road jobs on time ...efficiently and economically.

A-3158

Jaeger 600 c. f. m. Compressor with 2 wagon drills
...Winkelman Co., Syracuse, N. Y.

speeds up work on the Pennsylvania Turnpike!



Lima 604 and 2 Jaeger Pumps . . .
The Pavia Co., Verona, Pa.

Allis-Chalmers HD-19 with Baker Hydraulic Bulldozer . .
Ruth Construction Co., Scottsdale, Pa.

Lima Paymaster and Lima 604 . . .
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Highway EQUIPMENT COMPANY

6465 Hamilton Ave.
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Allis-Chalmers • Jaeger • Baker • Gar Wood • Hough
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Engines • Lima Shovels, Cranes, Draglines • Mandt

TANDEM DRIVE
MOTOR GRADER

here's a value that invites comparison

Compare **THE PRICE!**
Compare **THE FEATURES!**
Compare **THE PERFORMANCE!**

. . . and you will agree

THE ALLIS-CHALMERS MODEL D IS YOUR BEST BUY... BY A LONG WAY

only **$3,585**

F. O. B. Springfield, Ill. Taxes and attachments extra. Price subject to change without notice.

FOR SOME JOBS On All Projects

FOR ALL JOBS On Some Projects

ALLIS-CHALMERS MODEL D

WEIGHT — 8,500 lb. (bare)
BRAKE HP.— 34.7 (famous Allis-Chalmers gasoline engine) • SPEEDS—four forward, 2.40 to 18.61 mph.; reverse to 2.9

Not a converted job . . . it's ENGINEERED NEW FROM THE GROUND UP—to bring you BIG grader design and performance advantages:

- TANDEM DRIVE
- TUBULAR FRAME
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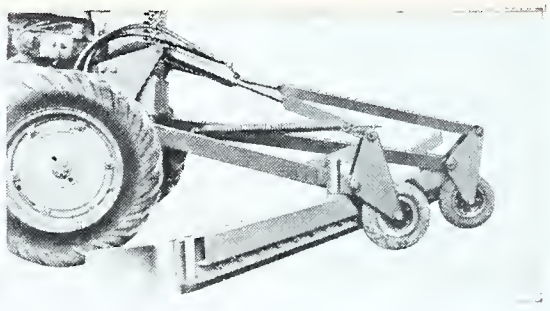
- FULL VISIBILITY
- SIMPLIFIED SERVICING

. . . Plus special attachments that widen its usefulness—Rear-End Loader, Scarifier, Windrow Eliminator, "V" or Blade-Type Snowplows. Also, various other accessories. Electric starter and lights standard equipment

HYDRAULICALLY CONTROLLED SCARIFIER—Located back of circle for greater down pressure. Fast, accurate ripping, controlled penetration. Easy, positive steering resulting from greater front-end stability.

LOADS MATERIAL into trucks with Tractomotive Loader—from windrows and stockpiles . . . surplus dirt or snow. Hydraulically operated, simple to mount ⅝ cu. yd. bucket — available with bucket teeth.

WINDROW ELIMINATOR SAVES TIME. This rear blade saves extra pass by feathering out windrow from grader blade. Means safer traffic conditions, too. Specially designed for the Model D.



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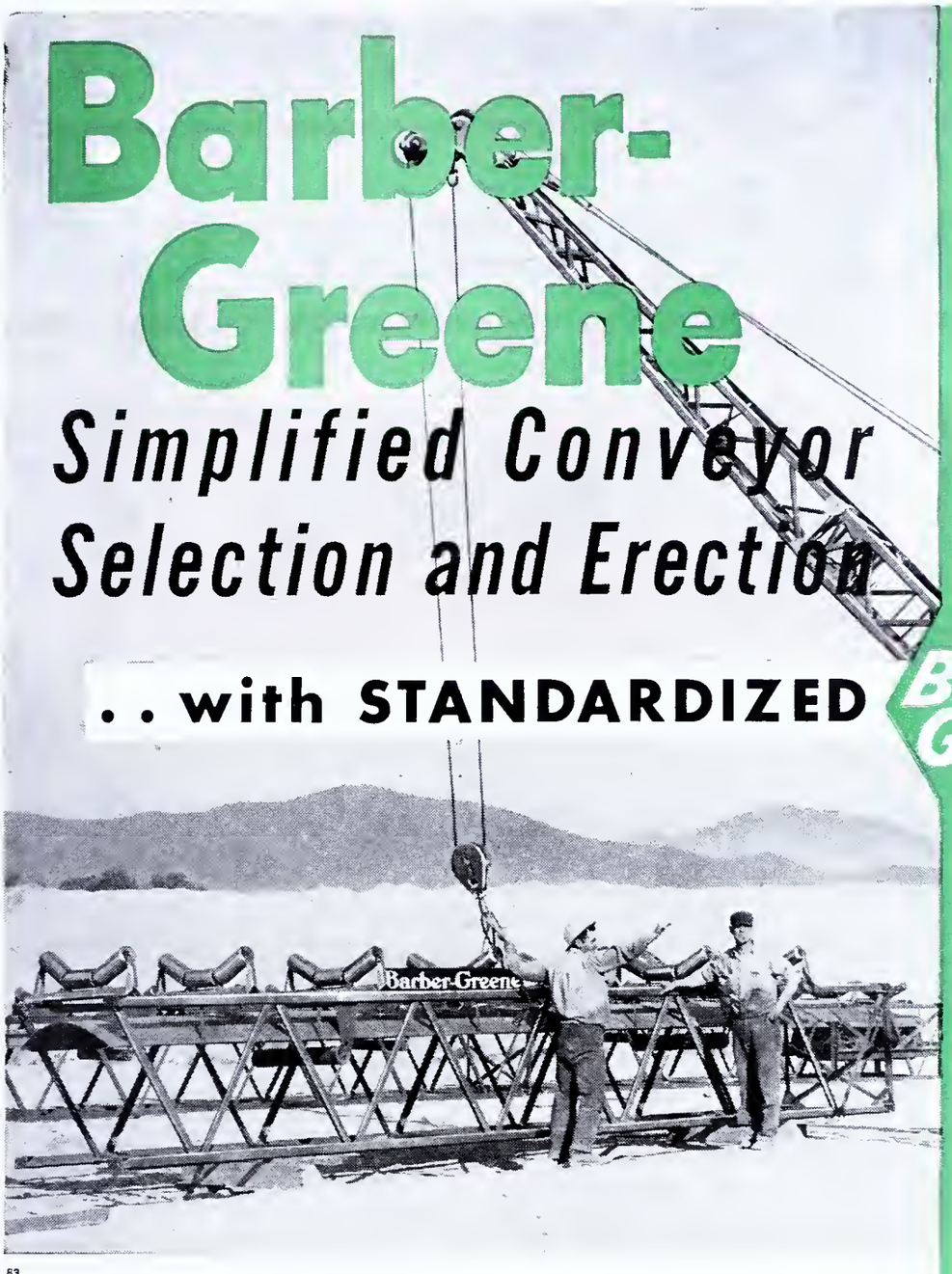
"SEEING IS BELIEVING." ASK YOUR ALLIS-CHALMERS DEALER FOR A DEMONSTRATION.

Barber-Greene

Simplified Conveyor Selection and Erection

. . with STANDARDIZED B-G units



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Barber-Greene Permanent Conveyors are complete, self-contained, *standardized* units that can be bolted together quickly . . . easily altered and moved. Field assembly of miscellaneous pulleys, bearings, and dozens of other parts is completely eliminated. The *pre-engineered*, factory-assembled terminals operate at top efficiency . . . reduce maintenance expense.

Prefabrication reduces manufacturing delays . . . permits our sales engineers to give you prompt quotations. *Standardized* construction and stocking of principal parts mean quicker delivery.

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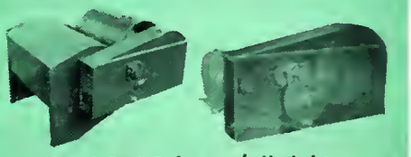


Head End Drive w/oil tight Speed Reducer

Head End Drive

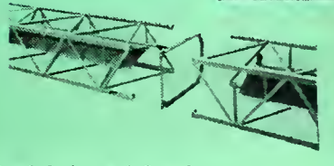
Horizontal Takeup

Screw Takeup

Vertical Takeup

Belt Scraper

Back Stop Brake



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Self-Propelled Earthmovers

Ralph Myers Contracting Co. on Turnpike Eastern Extension, Section 25-B in Lancaster County.

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BARNES — Pumps
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DIAMOND — Portable Crushers
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Multi-Purpose Earthmovers

H. J. Williams Co. on Section 23-B of Eastern Extension in Dauphin-Lebanon Counties.

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A Record for the TURNPIKE

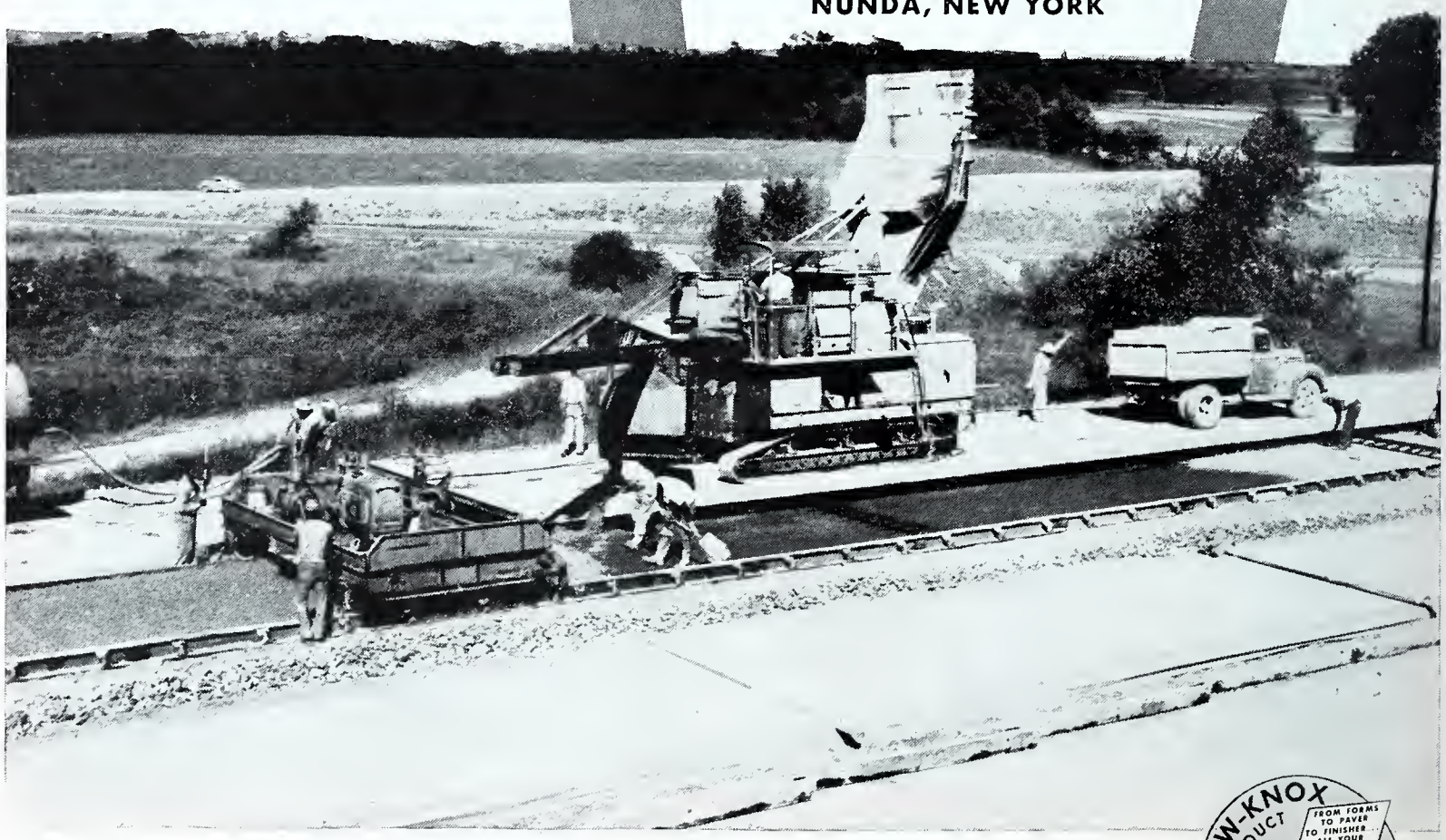
3547 lineal feet—4729 sq. yds. of 9-in., 12-ft. lane in 13 hours. That is the record established by the Williams Paving Company of Norfolk, Va., using one MultiFoote 34-E DuoMix Paver on sections 21B2 and 22A1 of the Eastern Extension of the Pennsylvania Turnpike. Not only is that a Record for the present section but it is a Record for the original construction as well!

High output was the result of the thorough organization and planning of the Williams Paving Company and the best in equipment.

THE FOOTE COMPANY, INC.
Subsidiary of Blaw-Knox

NUNDA, NEW YORK

MultiFaate 34-E DuoMix Paver on the Williams section af the Turnpike. Day after Day, trauble-free service, makes recards.



MULTIFOOTE PAVER

FOR EVERY PLACE CONCRETE MUST BE POURED

A BLAW-KNOX PRODUCT — FROM FORMS TO PAVER TO FINISHER ALL YOUR PAVING EQUIPMENT — IN ONE PACKAGE from BLAW-KNOX

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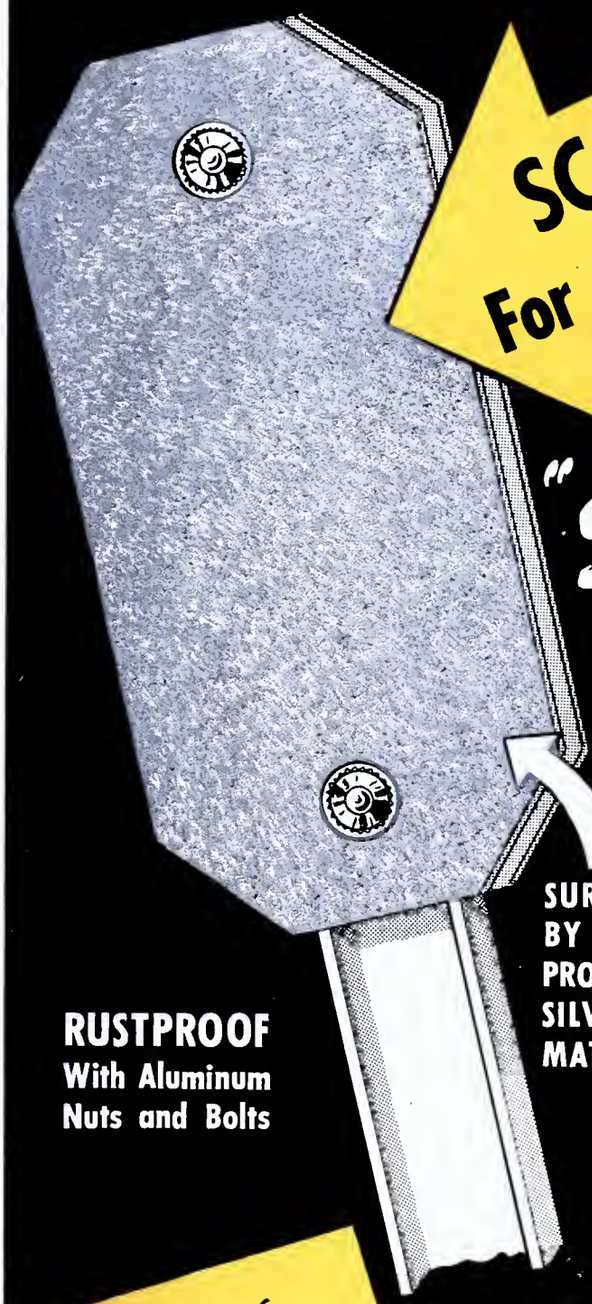
ON THE WORLD'S FINEST HIGHWAY

SCOTCHLITE* DELINEATORS For the PENNSYLVANIA TURNPIKE

"Sharp Delineation without glare"



SURFACE LAMINATED BY VACUUM STEAM PROCESS WITH SIGNAL SILVER SCOTCHLITE* MATERIAL

RUSTPROOF
With Aluminum Nuts and Bolts

SPECIFICATIONS FURNISHED UPON REQUEST

1¼" STEEL CHANNEL POST
Painted 2 coats "Rust-Oleum" rust preventive metal coating No. 769 & No. 575

The most efficient and modern delineation Scotchlite* Reflectorized material on Aluminum

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PENNSYLVANIA TURNPIKE COMMISSION
by
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Westinghouse LIGHTS THE WAY IN PENNSYLVANIA

Irwin terminus of the Penna. Turnpike

Carey Ave. Bridge, Wilkes-Barre, Pa.

HIGHWAYS
BRIDGES
STREETS

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Approved for these and countless other installations—the Westinghouse OV-20 Mercury Vapor Luminaire. Brighter light on the right of way is only part of the benefit story with our Planned Lighting Systems. The general betterment of public safety and welfare is another plus to warrant immediate aetion to light all major thoroughfares like those pietured above. Equally important to the lighting of any Highway is the design of the roadway itself. An outstanding example is the Pennsylvania Turnpike, so well designed and constructed that it is commonly referred to as the "World's Greatest Highway." It is with exceptional pride that Westinghouse has been identified with the interchange lighting of this super highway. Now with the advent of the Turnpike's extension, commemorated by the dedication issue of the HIGHWAY BUILDER, Westinghouse is proud to share in this pace-setting event.

YOU CAN BE SURE..IF IT'S Westinghouse

For the Record

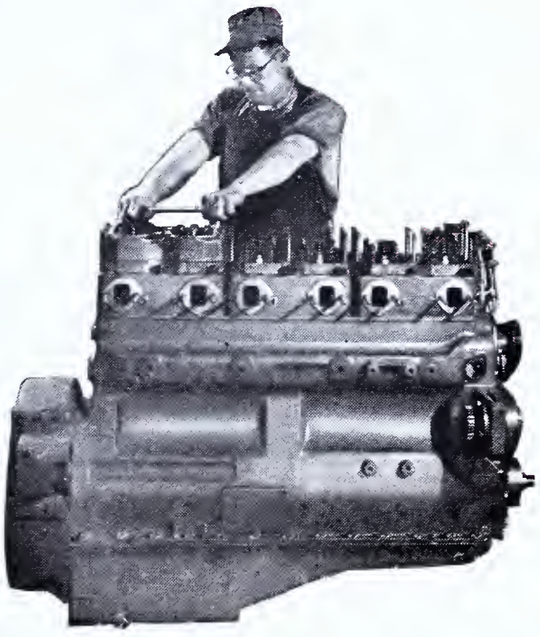
On February 28, 1947, the President of Keystone Automobile Club, J. Maxwell Smith, wrote to Governor James H. Duff, recommending the initiation of a program looking to the extension of the Pennsylvania Turnpike eastward toward Philadelphia.

Pointing to the imperative need for an adequate highway linking Philadelphia and the State Capital, he recommended Turnpike extension rather than a road built at tremendous cost to the Motor Fund. He emphasized the Club's long-held position that Keystone can approve establishment of toll roads "only on the ground that they provide entirely new facilities in shorter time than the State could construct them with monies from the Motor Fund without throwing the remainder of the highway system out of balance." He also urged that a route be chosen for the proposed extension that would "not adversely affect the highly productive farmlands."

On April 12, 1947, Governor Duff announced publicly at the dedication of Keystone's new headquarters in Philadelphia, that a survey would be made to determine a feasible route for the Eastern Extension. Events moved swiftly from that point, despite opposition of selfish interests which Keystone fought vigorously and successfully, until today, within the short span of three years, the Eastern Extension is an accomplished fact.

Keystone Automobile Club is proud of its part in the promotion of this great highway, which will unquestionably prove its worth to the motoring public as increasing car registrations place a staggering burden on the highway system.

Cummins® Custom-built Diesels



Built not once but

Twice

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Every lightweight high-speed Cummins Diesel is actually built *twice*. After initial assembly, each engine is run-in on the test block. Then it is torn down and carefully re-inspected — after that it is re-assembled and tested *again* to assure *peak performance*. And that is only *one* example of the extra care, the precision-workmanship . . . that goes into every Cummins custom-made engine.

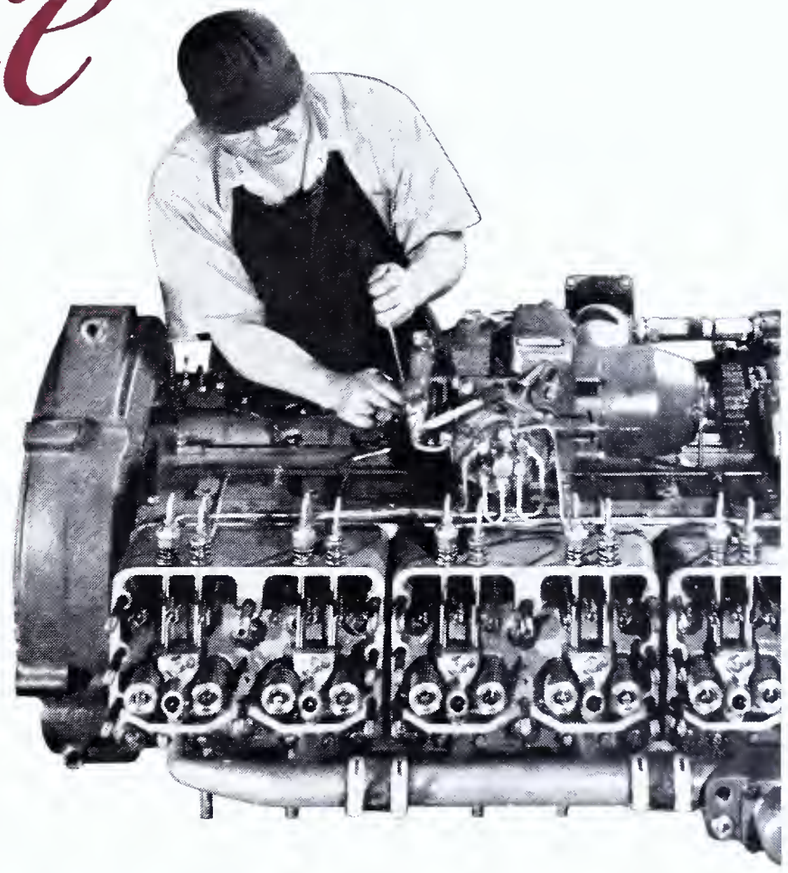
That's why a Cummins Diesel is an investment that has *greater earning power* for you. The finest of engine-craftsmanship...exclusive Cummins fuel system...and custom-built engines "that fit your job" make a rugged, quality-engineered Cummins Diesel *the better buy for your power needs.*

Contact your Cummins dealer. He has more facts to show you about making more profits with

CUMMINS Dependable DIESEL

TRADEMARK REG. U. S. PAT. OFF.

Diesel power by CUMMINS



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HIGHWAY BUILDER

OCTOBER, 1950 VOLUME 29, NUMBER 10

A Magazine Of, By and For Contractors

Official Organ ASSOCIATED PENNSYLVANIA CONSTRUCTORS

A. EARL O'BRIEN, Executive Secretay — Editor MAXWELL E. WYLE, Assistant Editor

SUBSCRIBING ORGANIZATIONS

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AMERICAN ROAD BUILDERS' ASSOCIATION

THE CONTRACTORS ASSOCIATION OF PHILADELPHIA, H. A. Windisch, Executive Secretary

(The above organizations assume no responsibilty for the editorial policy of this publication, except articles appearing under their signatures.)

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EDITOR'S NOTE: The views and opinions of contributors of articles to HIGHWAY BUILDER do not necessarily reflect the policies of the Associated Pennsylvania Constructors. According to the American way of life we open our columns to all reliable shades of opinion but we can accept no responsibility for same. Nor do the contributors accept responsibility for the Editorial policy of this publication.

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WHEN YOU WANT TO RENT EQUIPMENT

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Let our skilled mechanics, complete machine shop and welding department prove to you our ability to rebuild equipment from the bottom up. Being authorized distributors of Hercules Engines in this area, we are also equipped to convert your power units to Hercules Diesel. Call for free estimates.

WHEN NECESSARY TO REPAIR EQUIPMENT

A small adjustment may do the trick. Or a complete overhaul may be needed. Whatever type of repair your equipment demands will be made promptly and correctly. Hundreds of parts on hand to give you quick replacements. When your job requires any one of our equipment services it will pay you to call Metalweld.

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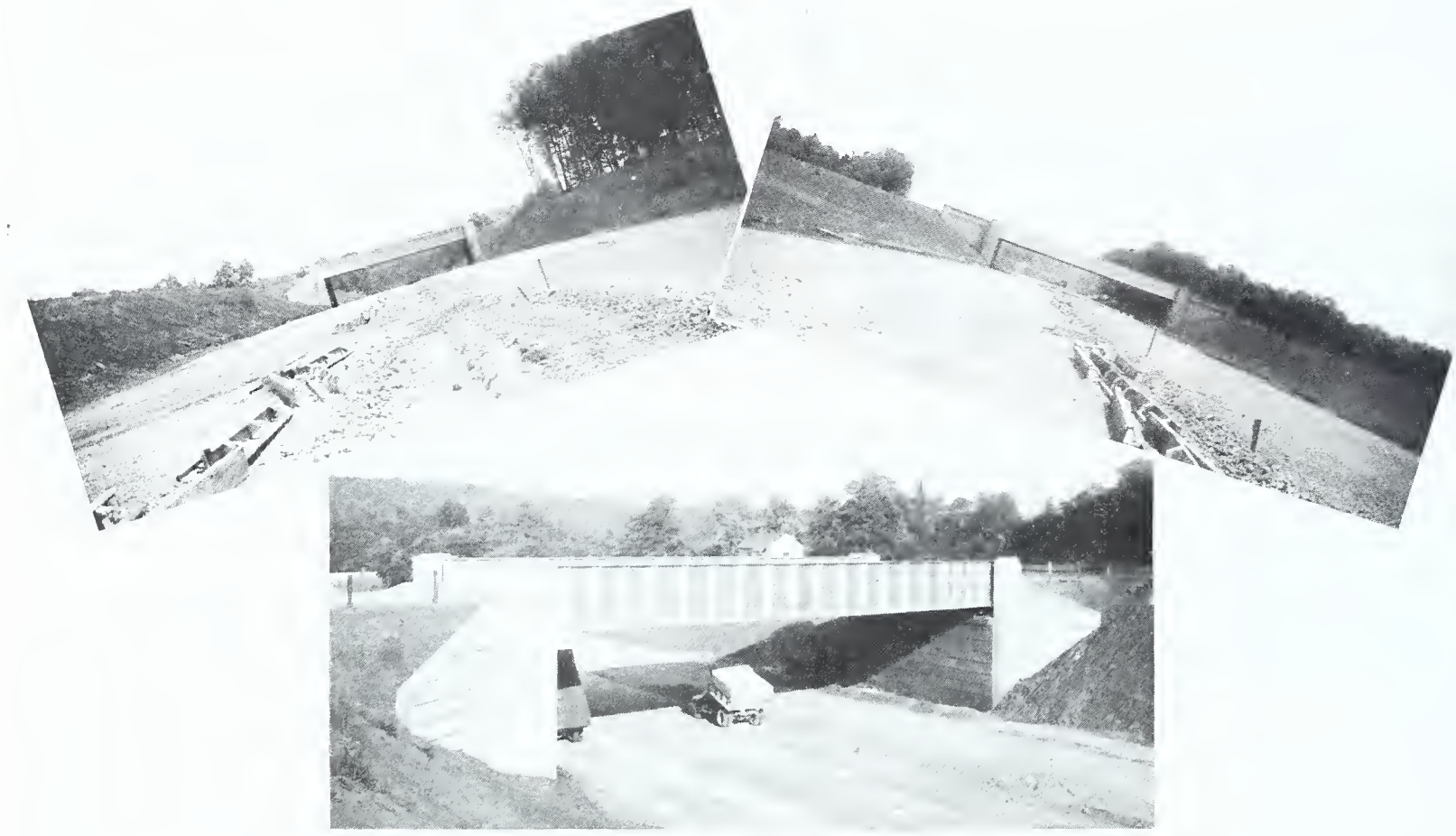
THE TURNPIKE . . .
. . . IN THE MAKING!



Views of work in progress near the borders
of Lebanon and Lancaster Counties.

BIG MACHINES for BIG JOBS

(...and Everything You'll Need for Any Job!)

. . .EUCLIDS and NORTHWEST shovels from STANDARD are setting performance records on the big, tough jobs. . . John Swanger, Inc. of Lancaster and the Thomasville Stone and Lime Co. are well satisfied with their performance in heavy rock (see photos) . . . . Although you'll find equipment from STANDARD on the big jobs, you'll also find it on jobs of every size and description. In STANDARD'S complete lines are machines that will perform efficiently, economically and profitably on any type of contract — on state, county and town work and in shops of all kinds . . . Let STANDARD show you how complete lines and top-notch service and parts facilities can help you on your next job!

STANDARD'S lines include EUCLID Trucks, NORTHWEST Shovels, Cranes and Draglines, SCHIELD BANTAM Shovels, AUSTIN-WESTERN Motor Graders, Crushers, Rollers and Sweepers, GENERAL MOTORS DIESEL ENGINES, JOY Compressors and Air Tools, GILSON Mixers, NOVO Pumps and many other famous lines of construction equipment and shop equipment.

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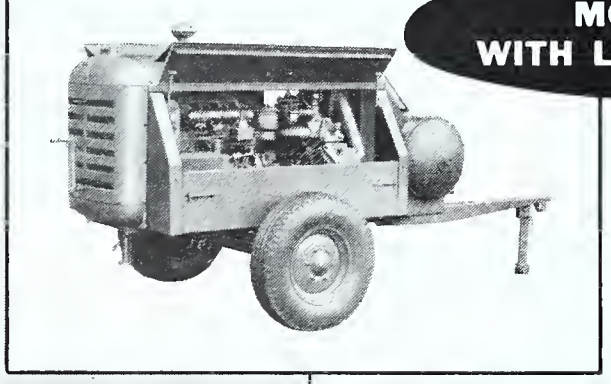
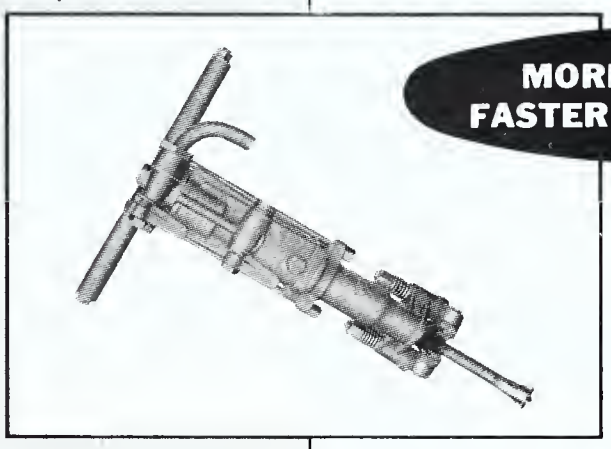
to Reduce Your Operating Costs ...with Ingersoll-Rand Equipment



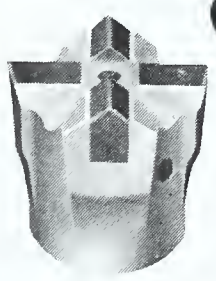
MORE AIR WITH LESS FUEL...

I-R "KA-Series "Mobil-Air" Compressors are equipped with the new Floating-Speed Drill-More regulator which saves up to 40% in fuel by eliminating wasteful idling, and by always compressing the needed air at the lowest possible speed. The slower average working speed of both compressor and engine means longer life of all parts and reduced maintenance costs. Jackhamers and other air tools now do up to 30% more work because I-R "Mobil-Air" Compressors furnish the Air at higher average pressures.



MORE POWER— FASTER DRILLING...

Pound for pound, the J-40 is the most powerful Jackhamer in its class. Weighing only 45 lbs., it combines strong rotation with high drilling speed and easy handling. It is ideal with I-R Carset Jackbits. While it is light enough and fast enough for general work, it will also handle many of the "Big" jobs. It is particularly applicable for general utility service in mines and is extensively used on road jobs and in quarries. You'll like its low air consumption, too. The J-40 is furnished with a three-in-one backhead for blower, plain dry, and wet drilling. There's a correct size and type of I-R Jackhamer for all drilling jobs.



MORE FEET OF HOLE PER SHIFT...

Footage drilled or yards of rock broken can be greatly increased by the use of I-R Carset Jackbits. These bits, with inserts of tungsten carbide, drill hundreds of feet with practically no loss of gauge. Drilling speed is usually doubled and the amount of effort needed to hold the drill greatly reduced. Hole after hole can be drilled with one size bit. 40% reduction in air consumption is possible and drill maintenance is often reduced as much as 30%. And up to 30% less blasting powder is used in the small, uniform diameter holes drilled with Carset Jackbits.

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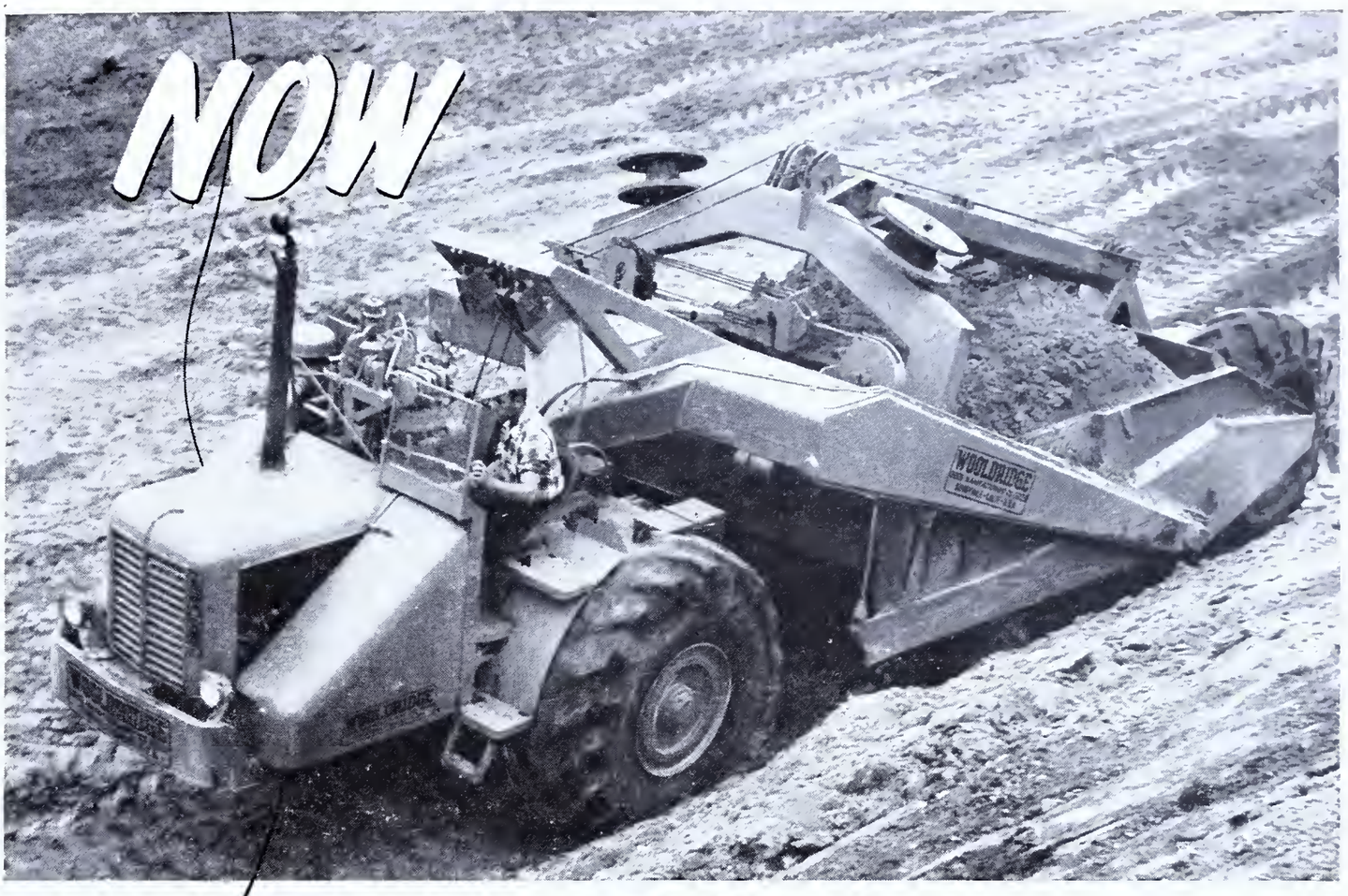

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BIGGER TIRES Big 24:00 x 25 24-ply low-pressure tires give increased traction, flotation, load-carrying capacity.

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Governor

Commonwealth of Pennsylvania

COMMONWEALTH OF PENNSYLVANIA
GOVERNOR'S OFFICE
HARRISBURG

THE GOVERNOR

It is extraordinarily fortunate that the Eastern Extension of the Pennsylvania Turnpike is completed and open to traffic at a time when it is needed to the utmost.

While this road was not intended as a military highway, it nevertheless is the greatest military highway anywhere in the world whatever its original purpose. It will enable the transportation by truck across Pennsylvania of vitally needed war materials in the quickest time that similar transportation can be effected anywhere in the world.

These uses, of course, are only an addition to the marvelous peacetime uses of a four-lane, non-stop, non-red light highway through congested areas of Pennsylvania without any of the dangers or handicaps of congestion that traffic ordinarily has going through city streets.

I am extremely happy, therefore, to have this opportunity to extend my personal and heartfelt congratulations to everyone who made this timely achievement possible--to the members and employes of the Pennsylvania Turnpike Commission; to the engineers and their staffs who designed the highway; to the members of the Associated Pennsylvania Constructors, their employes, workers, and all others who actually built this great highway.

Yours is a job well done, a monument to achievement which will contribute much to helping solve whatever wartime problems may face both the Commonwealth of Pennsylvania and the entire Nation.

Jas. H. Duff

James H. Duff
Governor

Pennsylvania Turnpike Commission

JAMES J. COYNE
Director of Maintenance

JAMES J. TORRANCE
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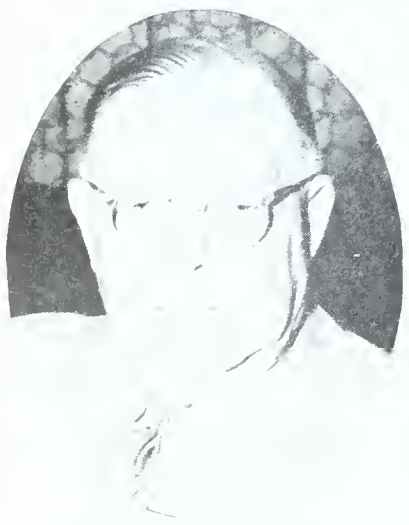
T. J. EVANS
Chairman



EDWARD N. JONES
Director of Public Relations

RAY F. SMOCK
Secretary of Highways
Ex-Officio

COMMONWEALTH OF PENNSYLVANIA

OFFICE
OF
THOMAS J. EVANS
CHAIRMAN

PENNSYLVANIA TURNPIKE COMMISSION
11 NORTH FOURTH STREET
HARRISBURG

Greetings:

The opening to traffic of the Philadelphia Extension marks another great achievement in the rich history of progress made by our Commonwealth. By it, the World's greatest highway, the Pennsylvania Turnpike, is increased by 100 additional miles which brings us closer to the attainment of our goal; "A turnpike System which will reach across the State from border to border." As a result of its construction it offers to the public a modern express-type highway which will afford comfort, economy, convenience and safety. It is the road of tomorrow made available today.

It is fitting that proper credit be given to those who participated in its creation. It was built as a result of a remarkable teamwork. Outstanding in this teamwork is the splendid contribution made by the Governor of the Commonwealth, the Honorable James H. Duff. It was he who took the idea of a Philadelphia Extension and gave it life. He extended every effort to make it a reality.

Working untiringly toward this goal also were the members of the Pennsylvania Turnpike Commission: Mr. James F. Torrance, Secretary-Treasurer; Mr. Edward N. Jones, Director of Public Relations; Mr. James J. Coyne, in charge of Maintenance; and Mr. Ray F. Smock, Secretary of Highways, member Ex-Officio; the employees of the Commission; our Engineering Department; our Design, Traffic and Consulting Engineers; our Legal Staffs; our Trustee; our Principal Underwriters; the Department of Highways and our Contractors. To all I give my sincere thanks for their unselfish devotion and salute them for their loyalty.

It would be amiss to neglect those who contributed greatly to this great project who are not present with us today to share in this event. I refer to Mr. John D. Faller, General Counsel, and Mr. Charles S. Newton, Comptroller, now deceased. Their efforts and contribution will never be forgotten.

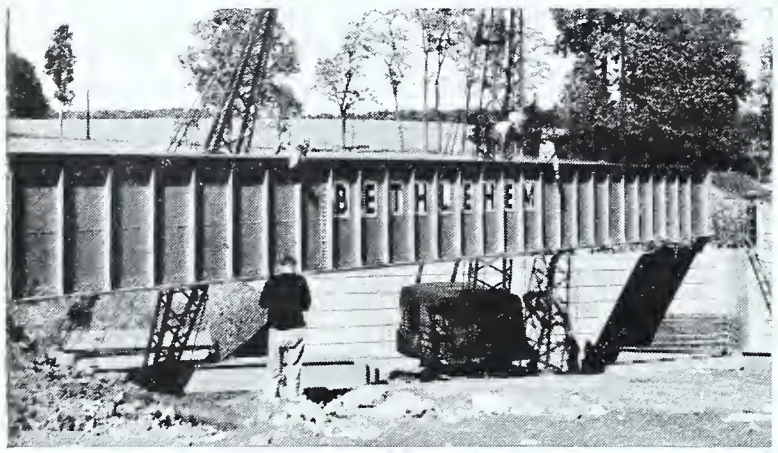
It has been my privilege to be associated with the Pennsylvania Turnpike Commission since the beginning of the construction of the original Turnpike. With the thrill of the completion of this new extension giving new inspiration I look forward to greeting you soon upon the opening of the next link in our Turnpike System - The Western Extension. God Willing, let us now look forward to this fast approaching day.

Sincerely,

T. J. Evans
Chairman

On the Turnpike Extension

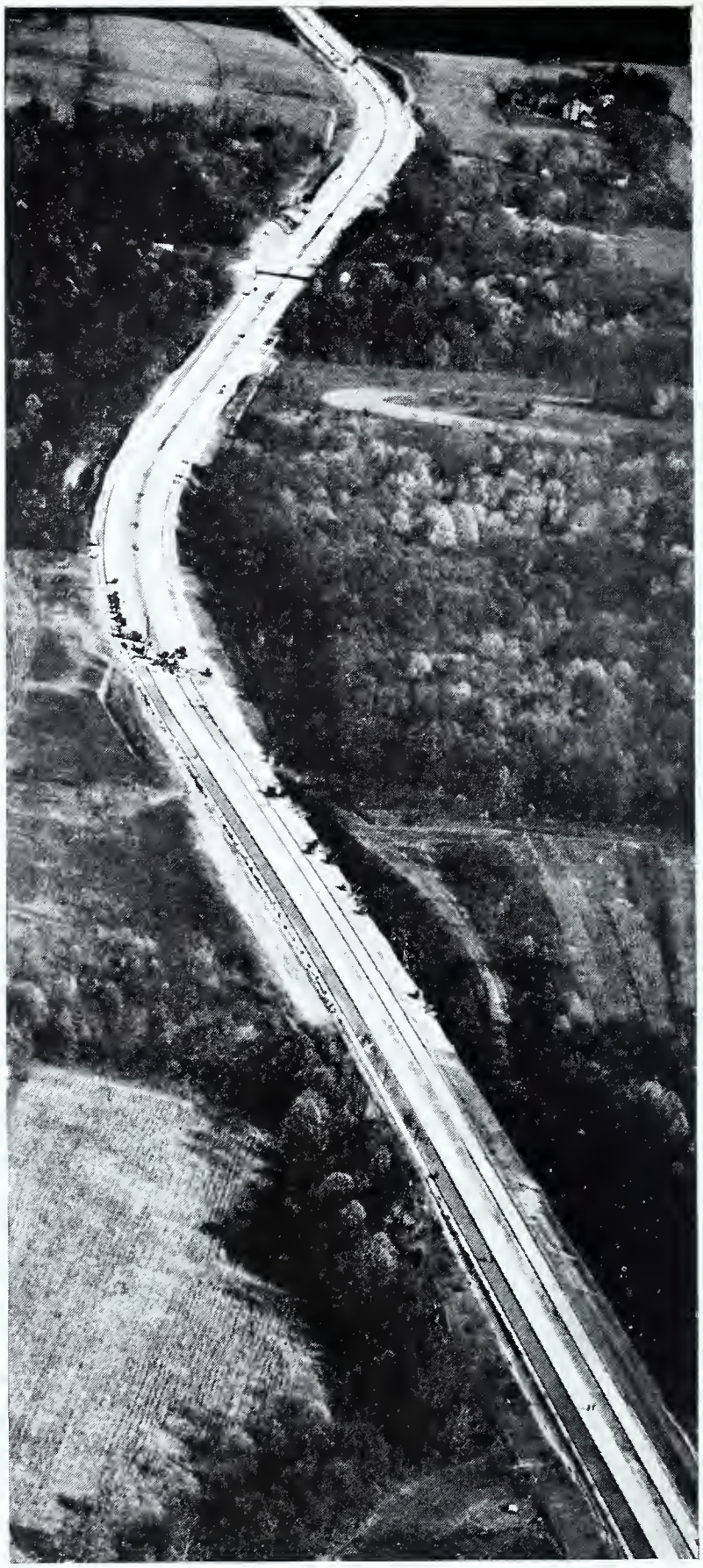
By extending the eastern end of the famous Pennsylvania Turnpike from Middlesex, Pa., to King of Prussia, northwest of Philadelphia, the Pennsylvania Turnpike Commission has brought closer its goal of a limited-access toll road spanning the Keystone State from east to west. The accompanying pictures were taken at various points along the new 100-mile Turnpike extension, and show representative uses of some of the steel products furnished by Bethlehem for this most famous of express highways.



Large Bethlehem-built girder, one of many steel girders used in constructing new Turnpike bridges, being inched into place by heavy crane.

Bethlehem Dowel Unit, designed to minimize load-transfer problems by permitting free movement of dowels in slab, about to be covered with concrete.

Workmen carry Bethlehem Hinged Bar Mat into place after first pour. Mat folds over double, installs fast. Completed lanes shown in background.



Airview showing construction activity on 100-mile eastern extension of the Pennsylvania Turnpike, at a point approximately due south of Lebanon, Pa.

BETHLEHEM STEEL COMPANY, BETHLEHEM, PA.

On the Pacific Coast Bethlehem products are sold by Bethlehem Pacific Coast Steel Corporation. *Export Distributor:* Bethlehem Steel Export Corporation

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Sheet- and H-Piling • Fabricated Structural Steel

BETHLEHEM STEEL

Pennsylvania Turnpike--- The World's Greatest Super-Highway

ORIGINAL Turnpike of 160 miles, created by Legislative Act #211 of May 21, 1937. Construction started November 1938 and opened to traffic October 1, 1940. Contracts numbered 53 - awarded to 41 contracting firms, including seven tunnels.

Philadelphia Extension of 100 miles, created by Legislative Act #11 of May 16, 1940. Construction started September 28th, 1948 and opened to traffic in October, 1950. Contracts numbered 28, including the bridges — awarded to 17 contracting firms.

Western Extension of 67 miles, created by Legislative Act #10 of April 15, 1941. Construction started October 24th, 1949 — planned to be opened to traffic latter part of 1951. Contracts numbered 27, including two bridges and three viaducts — awarded to 18 contracting firms.

The original Turnpike, Philadelphia and Western Extensions constitute the Pennsylvania Turnpike System, totaling 327 miles, slightly more than 1/8th the distance from New York City to San Francisco, with minimum right - of - way of 200 feet in width, totaling approximately 8,000 acres, enclosed by 654 miles of fence — with no grades of more than 3% or curves of more than 6 degrees.

The 327 miles of two, twelve-foot concrete traffic lanes in each direction of travel are separated by a ten-foot median strip, with ten-foot shoulders on the outside of each the lanes. The Turnpike System has no crossings at grade. Grade separations for the 327 mile length number 378 highway and railroad — and 274 stream and river crossings. Three of the latter are of major proportion, the bridges spanning the Susquehanna, Beaver and Allegheny Rivers. Included on the original Turnpike are also seven tunnels totaling 6.7 miles piercing seven mountains of the Appalachian range.

Enabling legislation was approved in the last session of the General Assembly allowing the Turnpike Commission to build extensions from the Turnpike or the Western Extension to a point at or near the City of Erie and from a point near Harrisburg to a point at or near the City of Scranton.

Not one penny of the more than a fifth of a billion dollars cost of the Turnpike System came out of taxes. The people who use it are willing to pay for the time, gasoline and labor saved through travel on the World's Greatest Highway. This is of inestimable saving to the taxpayers of the Commonwealth in expense of repair and upkeep of the State Highway System.

It is estimated that about three million vehicles will traverse the Philadelphia Extension of the System the first year of operation. If the pattern of the original Turnpike follows they will account for about one hundred and eighty-eight million miles of travel. This amount, added to the travel on the original Turnpike will account for more than a half billion-vehicle miles driven on the 260 mile Philadelphia Extension and original section the first year of operation.

The Turnpike System will be equipped with the world's most modern radio communication system. Twenty-four interchanges, maintenance buildings, tunnels, police and maintenance headquarters, patrol, service and maintenance vehicles will be equipped with two-way radio for complete coverage of the 327-mile system. In addition, teleprinter facilities will be provided from one end to the other. This system is made possible by a chain of unattended microwave relay stations, strategically located at elevated sites along the course.

The Turnpike System is an efficient, arterial medium for serving and being served by Pennsylvania's great industries and rich agriculture and will always be a gate-way to our vast Commonwealth — impressive with beauty, abundant in historic sites and shrines and with ample facilities for all who are seeking pleasant vacation spots in the mountains or on our streams and lakes.

Governor James H. Duff breaking ground for the Philadelphia Extension of the Pennsylvania Turnpike System on September 28, 1948.

22 BRIDGES and STRUCTURES

on the

Philadelphia Extension

Pennsylvania Turnpike System

Bridge in Dauphin County

Contract 205, Sec. 23-B

Contract 215, Sec. 25-A

Built By

H. T. OSBURN and COMPANY, Inc.

ENGINEERS and CONTRACTORS

631 Twelfth Street

Franklin, Pa.

The Building of The Eastern and Western Extensions of The Turnpike

By Roger B. Stone, Chief Engineer
Pennsylvania Turnpike Commission

THE BUILDING of these two extensions required careful planning in order to obtain the best quality of workmanship in a modern super highway within a predetermined time. In general, this planning was based on the experiences in constructing the original 160-mile Turnpike ten years ago.

Since the travelling public has recognized the advantages of the existing Turnpike the two extensions have the same general design plus some new and improved features which have been developed during the last ten years, such as air-entrained concrete and a selected sub-base under the concrete pavement. Also, maximum grades and degrees of curvature were reduced from those on the original Turnpike. The Philadelphia Extension has a two per cent maximum grade and three degree curves and the Western Extension has a three per cent maximum grade and four degree curves. The service stations and maintenance buildings are larger in area and capacity so as to accommodate the increasing volume of travel and maintenance.

The requisites of planning this project include the following:

1. The organization of supervisory personnel in all departments.
2. The selection of the best general route for the extensions.
3. The determination by aerial survey of the exact route and its approval by the Commission.
4. An engineer's total cost estimate based on quantities and unit prices.
5. Traffic surveys and estimate of earnings.
6. Financing.
7. Preparation of contract drawings.
8. Increase in number of personnel, including engineering, legal, auditing, purchasing, clerical and testing of materials.
9. Advertising and awarding of contracts.
10. General construction, such as grading, drainage, paving, bridges, interchanges, ticket offices, maintenance buildings, service stations, fencing, guard rail, radio.

After the preparation of contract plans every phase of the entire project was handled by Commission personnel. The central office of the Commission is located in the Pennsylvania Turnpike building in Harrisburg.

The 100-mile Philadelphia Extension was divided into three construction districts of about equal length, with a district office in Highspire, Ephrata and Downingtown, each office having a District Construction Engineer in charge. These sites were selected with consideration being given to accessibility to the work, housing facilities for the engineers, and other advantages of secondary importance. Likewise the 67-mile Western Extension has District offices in New Kensington and Ellwood City with a Division Construction Engineer in general charge.

The District Construction Engineers have supervision over the work in their districts and report to the Chief Engineer's office in Harrisburg. Each district is divided into construction sections, each section representing an awarded contract in that district. A resident engineer with his inspectors and survey corps has charge of each contract.

There are also in the Central office department heads who supervise the inspection and testing of materials, bridge and roadway designs; building construction of ticket offices and maintenance buildings; safety department; public utility relocations; contracts and specifications; public road relocations; blue printing; photostating; and photography. Other departments are the Legal, Right-of-Way, Auditing, Purchasing, Publicity, Personnel, representatives of the Consulting Engineers and Department of Highways.

The contract drawings for both roadway and bridges were prepared by six engineering firms, all plans and specifications being subject to the approval of the Chief Engineer, the Consulting Engineers and the State Highway Department. The specifications were prepared by Commission Engineers.

In the building of these two extensions, a total of 167 miles, there were certain difficult sections requiring a longer period of time for construction than others, such as the three major bridges over the Susquehanna, the Allegheny and the Beaver Rivers. Hence, these particular sections were designed and contracts awarded as early as possible so that the Extensions might be opened on schedule.

In building this project careful consideration was given to bid advertising, time of bidding period, allowed contract time, awards, start of work, current and final estimates, change orders and final acceptance of the work. Forty-five contracts were awarded in the construction of the main roadway and bridges ranging in value from $200,000.00 to $7,100,000.00, and the least number of bidders on any contract was two and the greatest number seventeen, with an average of about eight bidders for each contract.

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Financing The Pennsylvania Turnpike System

By Walter H. Steel, Drexel & Co.

CEREMONIES observing the completion of a new project also serve to record achievement. On such occasions man permits himself "time out" to view, with understandable pride, his most recent creation. On the occasion of the opening of the Philadelphia Extension of the Pennsylvania Turnpike many persons and organizations rightfully share such pride. Governor Duff, speaking last year at the Turnpike anniversary dinner, commented to the effect that construction of the "World's Greatest Highway" was the result of teamwork of numerous and varied specialists. This team was assembled, and its efforts directed and coordinated, by the Turnpike Commission under the very able leadership of Chairman Evans. Part of the team was the "Bankers," or "Principal Underwriters" as they are referred to in that important legal document, the Trust Indenture. Speaking for the Bankers, I can say that their feeling of pride in the project is as great as that of any other member of the team, and to them the Turnpike System is a monument representing achievement just as positive as that of the engineers who have brought to life the dreams and plans of the Governor, the Legislature, and the Commission. The achievements of the Commission, the engineers, the attorneys, and the Bankers individually and collectively stand as a pattern for all similar undertakings that have followed the proven success of the Pennsylvania Turnpike System.

In describing the financing of the Turnpike System, I shall do so in summary form and with as little technical language as possible, presenting only the basic fundamentals involved.

1. The Principal Underwriters

Four investment banking firms were selected to develop a program for financing construction of the Philadelphia and Western Extensions and, if possible, for combining into one system the original Turnpike and the two Extensions. These firms were Drexel & Co. of Philadelphia, B. J. Van Ingen & Co., Inc. of New York, Blyth & Co., Inc. of New York, and The First Boston Corporation of New York. The second named firm had been identified with the Turnpike financing since 1938 when it worked in conjunction with the Commission and the R. F. C. in the marketing of the original bonds. The group of bankers named above was assembled in 1945 to study the possibilities of placing the then outstanding bonds on a lower interest cost basis. These studies resulted in the 1946 refunding which not only lowered the interest rate borne by the Commission's original bonds by 1¼%, but broadened considerably the market for the securities and in addition gave them national sponsorship.

2. The Turnpike System

The 1937 legislation created the Pennsylvania Turnpike Commission and authorized the construction and operation of a turnpike between Irwin, near Pittsburgh, and Middlesex, near Harrisburg. This super, limited access highway, opened to traffic in 1940, is sometimes referred to as the "original Turnpike" or "the existing Turnpike" and forms the backbone of what is now called "The Turnpike System."

An Act of 1940 authorized the construction and operation of a turnpike eastward from Middlesex to Philadelphia, and an Act of 1941 authorized the construction and operation of a turnpike from Irwin to the western boundary of the State, touching on the State of Ohio.

The war years, of course, intervened before definite action could be taken toward implementing the 1940 and 1941 directives of the legislators. In 1947, however, additional legislation was enacted making it legally possible to combine the three separately authorized turnpikes. The intent was to establish one overall highway maintained and operated by one Commission and financed by the sale of bonds payable from revenues to be derived from traffic on any and all parts. This overall highway is herein called "The Turnpike System," and the Philadelphia Extension is that part now being opened for traffic. The Western Extension is under construction and is expected to be ready for traffic in another year.

With the legislative authority established, the Commission requested the Bankers to submit for its consideration a financing program so that it might proceed with plans for the construction of the two Extensions.

3. Problems in Evolving a Financial Program

In evolving a program for the Turnpike System rather than for the component parts separately, many problems basic in character were encountered. Principal among these were the following. The Trust Indenture in connection with the 1946 bond issue contained, among other things, provisions restricting the use of revenue solely to purposes of the then existing Turnpike. In other words, so long as the 1946 bond issue remained outstanding, tolls and other revenue could be applied only to operation, maintenance, and debt service of the Turnpike between Middlesex and Irwin. The problem, therefore, was to

(Continued on Next Page)

Edward Hopkinson, Jr. of Drexel and Co., passing checks covering $134,000,000 financing to Thomas J. Evans, Chairman, Pennsylvania Turnpike Commission, with Miles S. Altemose of Fidelity-Philadelphia Trust Co. looking on. It is the largest revenue bond financing transaction in American history.

either dispose of the debt and thus retire the Trust Indenture or, in effect, set up three separate operating and accounting divisions each with its own bond issue and Trust Indenture. This, from an operation standpoint, would be awkward and expensive and would increase the cost of financing as well. On the other hand, to retire the 1946 bonds through the means of a refunding issue would require under legislative enactments a coupon rate of interest at least ¼ of 1% lower than that borne by the outstanding bonds. Markets at the time were such as to make the discount on a term refunding bond issue prohibitive to the Commission. Further, the 1946 bond issue could not under its terms be called for redemption prior to maturity until December 1, 1951.

Another problem (assuming solution of the foregoing) concerned the extent of financing at any one time. Should both Extensions be financed together, or should they be undertaken separately? If separately, would the market consider the "open end" (authority to subsequently issue equally secured debt) Trust Indenture a detraction so great that the interest rate and price on the initial financing would prove too costly? If financed at the same time, how would the market react to the necessarily greater dilution of proven earnings of the existing Turnpike by estimated earnings on the two Extensions?

4. Resolution of The Problems

Midnight oil was burned in large quantities, much mathematics was involved, and prolonged sessions between Bankers, Trustee, Commission attorneys and others were held before the problems were solved and the bonds presented to the buying public. Briefly, and in the order given in the foregoing section, the solutions follow. Freeing the 1946 Trust Indenture offered the only really practical and efficient method of combining the three turnpikes into one for all purposes. It was considered essential that the revenues accruing to the Commission through the operation of the existing Turnpike be made available for operations and debt service on the overall project. The Extensions were unproven and therefore, if financed on their own, presented certain risks for which bond purchasers would properly expect a greater return in the form of higher interest rates. There was therefore no alternative but to make provision to redeem the outstanding debt when it became callable in 1951.

In order to meet the requirements of the Act concerning the rate of interest to be borne by refunding bonds (¼ of 1% lower than the 2½% borne by the 1946 issue), it was decided to replace the outstanding Term bonds due in 1976 with Refunding bonds maturing serially from 1952 to 1968. This, in effect, shortened considerably the average "life" of the old debt and permitted tapping a market that afforded an interest cost lower than was possible with Term bonds.

Serial bond maturities, however, presented certain corollary problems: Possible market resistance to this form of toll project financing and, more important, the need to avoid possible ill effects of heavy debt maturities in successive years. To meet these problems it was agreed in framing the new Trust Indenture to route the "flow of funds" as far as debt service was concerned first to the payment of interest on all debt and second to the retirement of the Serial bonds. Such retirement may be either at maturity, by call in advance of maturity, or by purchase in the open market. Redemption of Term bonds issued for right-of-way, construction and other costs of the Extensions, may be effected through operation of the sinking fund only after the retirement of all Serial bonds. It is interesting to note at this point that the revenues of the Turnpike at present and those anticipated for the future are such that it is expected that all the Serial bonds will be retired well in advance of the final maturity. It also is anticipated that the subsequent retirement of the Term bonds through operation of the sinking fund will proceed at a rapid pace.

Notwithstanding the fact trat the outstanding bonds could not be called for redemption prior to December 1951, it was possible to satisfy the 1946 Trust Indenture by escrowing proceeds of the sale of the Serial 2 ¼% Refunding bonds to pay principal, interest to call date, and call premium. Provision was made in the new indenture requiring that such escrowed funds be invested in U. S. Government securities. In this way earnings from such investments in effect reduced the cost of the refunding.

The question of whether to finance one or both Extensions was resolved happily in a way that dovetailed with planning and engineering. It was decided to proceed in the first instance

(Continued on Page 160)

Seated left to right: Walter H. Steel, Drexel & Co., Philadelphia, Pa., Judge Elder W. Marshall, Reed, Smith, Shaw & McClay, Attorneys of Pittsburgh, Pa., Miles S. Altemose, Fidelity-Philadelphia Trust Co., Philadelphia, Pa., Thomas J. Evans, Chairman, Pennsylvania Turnpike Commission, James F. Torrance, Secretary-Treasurer, Pennsylvania Turnpike Commission.
Standing left to right: Henry D. Shenk, Pennsylvania Turnpike Commission, George F. B. Appel, Townsend, Elliott & Munson, Attorneys of Philadelphia, Pa., C. R. Shetterly, Mitchell & Pershing, Attorneys of New York, N. Y., Theodore S. Paul, Counsel to Pennsylvania Turnpike Commission, Lawrence S. Waterbury, Parsons, Brinckeroff, Hall & Macdonald Engineering firm of New York, N. Y., John Pershing, Mitchell & Pershing, Attorneys of New York, N. Y., W. J. Roberts, Comptroller, Pennsylvania Turnpike Commission, James G. Couffer, B. J. Van Ingen & Co., Inc., New York, N. Y., Horace W. Latimer, Fidelity-Philadelphia Trust Company, Philadelphia, Pa., Wilbur M. Merritt, The First Boston Corporation, New York, N. Y., Reginald M. Schmidt, Blyth & Co., Inc., New York, N. Y., H. Gates Lloyd, Drexel & Co., Philadelphia, Pa., Howard W. Taylor, Jr., Morgan, Lewis & Bockius, Attorneys of Philadelphia, Pa., Howard C. Petersen, Fidelity-Philadelphia Trust Co., Philadelphia, Pa., Robert Mitchell, Mitchell & Pershing, Attorneys of New York, N. Y., Donald P. Beardsley, Drexel & Co., Philadelphia.

Consulting Engineers in Turnpike Construction

By Herschell H. Allen
J. E. Greiner Co., Consulting Engineers

THE PART played by the consulting engineers is but one of the six cardinal functions which have contributed to the success of the Pennsylvnia Turnpike. These functions may be classified as Administrative, Legal, Engineering, Financing, Construction, and Maintenance and Operation.

The successful completion of the engineering phase in turnpike construction is dependent upon the proper execution of Administrative Functions and the integral part of Administrative Functions known as executive management.

The Pennsylvania Turnpike Commission, through its Chairman, the three members and one ex-officio member, has developed a high degree of effective executive management which may be cited as being principally responsible for the satisfactory completion of the existing Pennsylvania Turnpike. The Chairman is the Chief Executive. The supervision of fiscal controls and details of auditing is an important administrative duty which has been assigned to one of the members of the Commission. When the tremendous scope of the business under the jurisdiction of the Commission is considered, it may be realized to what extent adequate fiscal controls are necessary. Another of the Commission members has undertaken the task of public relations. In general, the Administrative Functions are not only of prime moment but are the most important of the six factors necessary to the accomplishment of a project such as the Pennsylvania Turnpike.

Another phase in the development of such a major undertaking is the Legal Function. Legislative requirements must be fully met and in the case of the Pennsylvania Turnpike System these are encompassed within the scope of several Acts heretofore passed by the Pennsylvania Legislature. Contractural relationships between the Commission and the various engineers and contractors with whom the Turnpike Commission conducts its business is a responsibility falling under the category of Legal Functions. Then, there are dealings from a legal standpoint with the various utility companies, the plants of which are affected by the construction and operation of the Turnpike System. The acquisition of the necessary land to furnish the right-of-way for the construction of the Turnpike, involving numerous parcels of real estate, with consequent damages to adjacent property, may also be considered as a Legal Function. Falling under the general heading of Legal Functions come the services of bond counsel, having to do with all legal matters concerning the financing of the entire cost of the project. The principle document prepared by the bond counsel is the Trust Indenture. This document is a trust agreement between the Commission and the Trustee, specifying in detail the method of handling both the Construction Funds and the Revenue Funds.

Not until after the Administrative Functions had gotten well underway, and all of the preliminary Legal Functions had been concluded, was it possible to begin the engineering work on the project. First, the topographic, hydrographic and cadastral surveys were completed. Then, economic studies were made, including the selection of feasible routes and traffic studies to determine traffic desire lines and the extent to which traffic of all types might be attracted to the project in several different locations. After the selection of feasible locations preliminary engineering studies were conducted to determine the relative economics of the Turnpike in two or more alternative locations. From these studies, comparative estimates of project costs were compiled in order to determine the location which would serve the greatest volume of traffic at the least expenditure for complete project costs. Estimates of complete project costs for the type of revenue bond financing involved in the financing of the Pennsylvania Turnpike System must include not only the actual cost of construction, but also all administrative and legal expenses, the cost of all right-of-way, the cost of preliminary investigations and preliminary engineering and all other engineering and architectural costs carried through to the completion of the construction work.

Therein lies the principal function of the consulting engineers. Before revenue bonds can be sold for financing large projects of the scope of the Pennsylvania Turnpike, the investors must be assured that the relationship between cost and revenues will warrant such investment. Not only have the buyers of Pennsylvania Turnpike Revenue Bonds insisted upon assurance that estimates of project costs are adequate and sufficient to cover all construction costs, but also they must be assured that all costs necessary to carry the project to completion are fully covered.

It is, therefore, the experience and ability of the consulting engineers which measure the confidence of the investors in the project as well as the extent of the hazards and risks to be assumed by the investors. Of equal importance are the ability and experience of the traffic engineers, upon whom rests the responsibility of predetermining volumes of traffic and gross revenues, extended sufficiently far into the future to assure investors of the financial feasibility of the project.

The work of the consulting engineers in regard to the estimating of costs extends further. They must also forecast the cost of maintenance and operation of the facility, in order to ascertain that net revenues, or revenues remaining after maintenance and operation costs have been deducted from gross revenues, will be ample to pay interest upon and amortize the entire investment.

The functions above generally outlined may be considered as matters precedent to the actual financing of the project.

The fourth cardinal function required for the successful completion of the Turnpike System may be referred to as the Financing Function. Money market conditions had to to be studied, to determine the possible effect of other issues which were to come on the market at approximately the same time the revenue bonds for the Turnpike System were to be sold. Interest rates had to be fixed. They could also have been affected by the other bond issues marketed during the same period of time, as well as by the hazards and risks involved in the engineering estimates of cost and revenue. Bond price had to

(Continued on Page 158)

9 Miles of Turnpike

by H. J. Williams Co., Inc.

Lancaster County
Contract #215
Section 25-A
$2,048,767.88
4.89 Miles

Dauphin - Lebanon Counties
Contract #205
Section 23-B
$1,766,215.99
4.31 Miles

H. J. WILLIAMS CO., INC.

YORK, PENNSYLVANIA

Pennsylvania Turnpike Receives Praise of Highway Secretary

By
RAY F. SMOCK
Secretary
Pennsylvania Department of Highways

COMPLETION of the Philadelphia Extension of the Pennsylvania Turnpike, the contracts under way on the western extension plus the record breaking volume of construction on highways throughout the Commonwealth combine to create a convincing demonstration of Governor Duff's ability to get things done.

Pennsylvania, long a leader in the quality and extent of its highway system is now, more than ever, pre-eminent in the field of transportation.

It contains more miles of Turnpike roadway and more miles of State highway than any other state in the Nation.

It is particularly gratifying in this year of troubled world affairs that the Philadelphia Extension of the Turnpike and the many miles of new highways constructed during this Administration are ready today to meet any challenge tomorrow may bring.

Vast improvements have been completed or well advanced on each of our main cross State highways north, south, east and west, during the three and one-half years of this Administration.

Both the principal east-west routes, the Lincoln and William Penn Highways have received many miles of multi-lane construction. Curves have been widened or eliminated by relocation. Other hazards have been removed. Routes 6, 322 and 422, which also are heavily traveled east-west routes, have been greatly improved. The north-south routes — the Lackawanna Trail, the Susquehanna Trail and Routes 309, 122, 220, 219, and 19 — have had a great volume of construction, reconstruction, resurfacing and widening completed or well started.

Pennsylvania now has more than 5,000 miles of roadways, exclusive of Pennsylvania Turnpike construction, that were newly constructed or reconstructed on the State Highway System since Governor Duff took office. This is record breaking progress but even greater achievements are forecast for the current fiscal year.

It has been an honor and a privilege to serve as a Secretary of Highways and to sit as a member, ex-officio of the Pennsylvania Turnpike Commission during these nearly four years of notable and outstanding accomplishments.

The Turnpike has been designed and engineered by men of vision. In this great roadway, soon to completely span the Commonwealth, we have one of the finest highways in the world. It connects many of our great cities and agricultural areas by a flow of traffic that is unimpeded by traffic lights or stop signs, which are so necessary through congested communities. The Turnpike serves those who choose to use its facilities. An incidental but highly valuable benefit is derived by the State Highway System through diversion of this volume of traffic.

In addition to this traffic relief the great highways that parallel the Turnpike — particularly the Lincoln and William Penn Highways — have been vastly improved.

Many sections of both highways have been converted into equally modern multi-lane roadway with traffic divisors and interchanges.

Pennsylvania's highway system and its great Turnpike combine to give the Commonwealth the finest and greatest highway system in the world.

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GOVERNOR OF PENNSYLVANIA

and

THOMAS J. EVANS, CHAIRMAN

JAMES F. TORRANCE, SECRETARY AND TREASURER

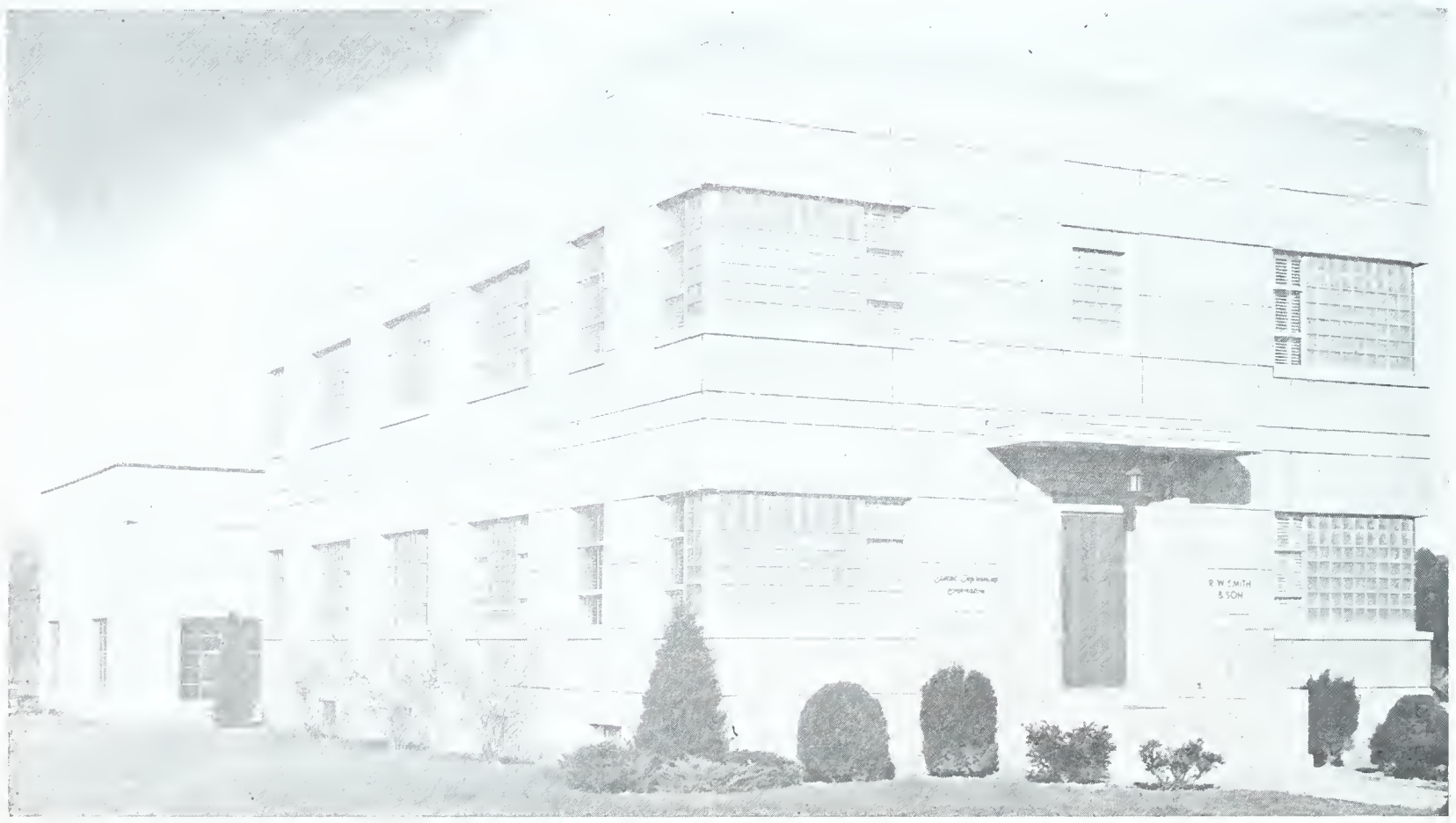
JAMES J. COYNE, COMMISSIONER

EDWARD N. JONES, COMMISSIONER

RAY F. SMOCK, SECRETARY OF HIGHWAYS (EX OFFICIO)

PENNSYLVANIA TURNPIKE COMMISSION

Congratulations on the completion of the Philadelphia Extension to the World's Finest Highway. The Capitol Engineering Corporation is proud to have participated in the design of this great project.



Capitol Engineering Corporation — Executive Offices — Dillsburg, Pennsylvania

Editorial Comment

Associated Pennsylvania Constructors

Third & State Streets — Harrisburg Pennsylvania

Democracy In Action

HIGHWAY BUILDER is justly proud to present this "Dedication Number" to mark the completion of the Philadelphia Extension of the Pennsylvania Turnpike System. Associated Pennsylvania Constructors has been signally honored in having its official publication designated to record the story of this monument to the skill and enterprise of the engineering profession and the construction industry.

Built at no cost to the taxpayers, the Philadelphia Extension is an outstanding example of what can be accomplished by government and private business working together — each playing its proper role. Planned by the Turnpike Commission, but financed and constructed by private enterprise, this gigantic project has simultaneously created wealth and provided a needed facility for public use.

Students of government will find in the conception and development of the Pennsylvania Turnpike System many sound examples of American democracy at work in the best interest of the public. Here is a quasi-public agency, created by government, functioning much the same as a private enterprise in order to furnish a facility which might well have been impractical, for either government or private enterprise to provide.

Again here is an outstanding example of proper, long-range planning. From its earliest days the Turnpike Commission conceived and planned for future extensions of the original section between Irwin and Middlesex. Now, within the short period of a decade, the Philadelphia Extension has been completed, the Western Extension is under construction and the first tributary link has been authorized.

From the beginning, the Turnpike Commission has made adequate provision for future growth of highway usage. This great system of highways is providing superior transportation to meet the requirements of more and more traffic.

Sound financing and good management have combined to make this magnificent Turnpike System an attractive investment for private capital. And yet provision has been made for the entire network to be turned over eventually to the public debt-free.

Probably the Pennsylvania Turnpike System will always confound and confuse our Socialist fringe. Created under a "New Deal" Democratic administration and expanded under a Republican administration, the Turnpike is a striking example that political parties can and do rise above petty partisanship when men of good-will catch the vision of constructive public service.

The accomplishments of the Pennsylvania Turnpike Commission deserve the plaudits of the Nation, and HIGHWAY BUILDER has welcomed the opportunity to publish the wealth of information data and illustrations assembled in this "Dedication Number". We are grateful to everyone who assisted in making this number a veritable handbook on the Philadelphia Extension. To the authors of the special articles we express our appreciation for their time and effort. A special word of "thanks" is due to our advertisers whose cooperation made possible this interesting and valuable compendium of facts.

Preparation and publication of this "Dedication Number" constitutes one of the biggest jobs ever undertaken by Associated Pennsylvania Constructors. With the fine cooperation of the Turnpike Commission this has been a pleasant task which we hope will contribute to the further expansion of the Pennsylvania Turnpike System.

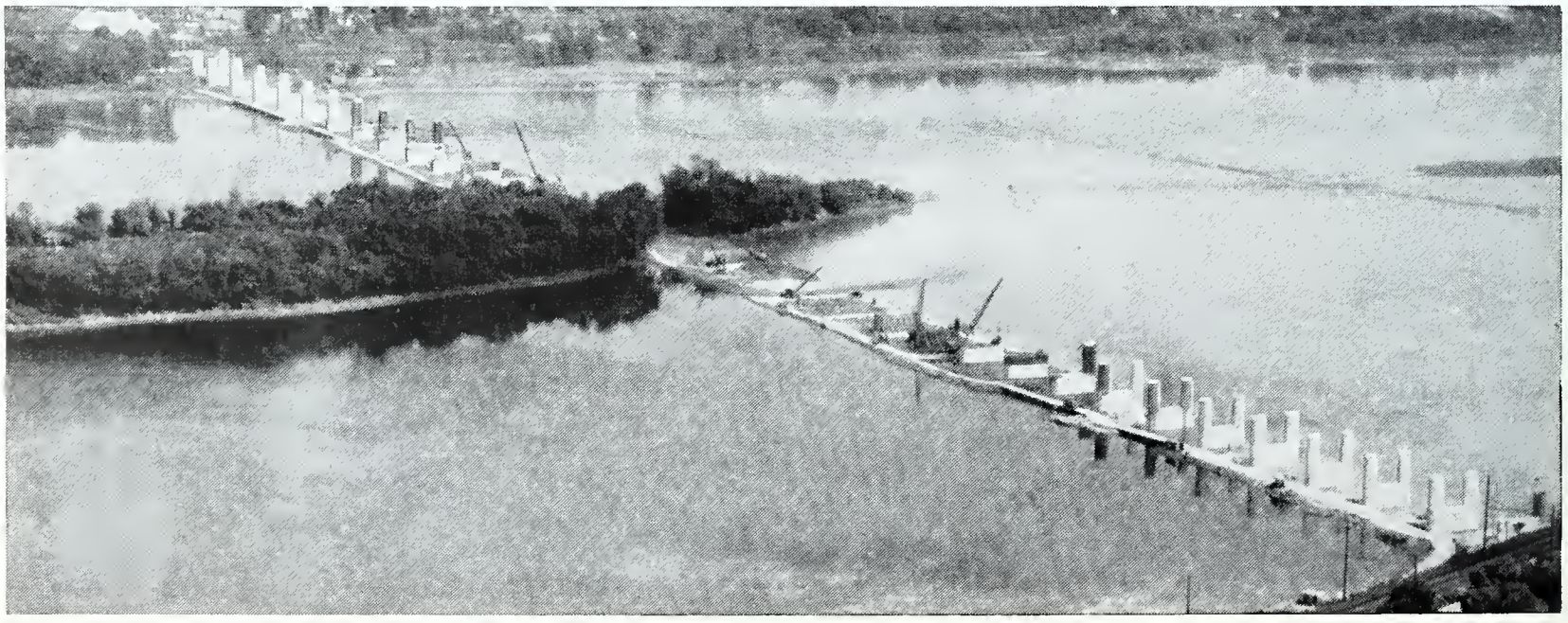
How the Susquehanna River was Spanned for the Turnpike's Eastern Extension

With the opening of the Pennsylvania Turnpike's Eastern Extension, automobile and truck traffic will speed across the Susquehanna River on a broad concrete and steel span, that is the major structure on both the original Turnpike and its Eastern Extension.

Booth & Flinn, General Contractors of Pittsburgh, are proud of this important contribution to the Pennsylvania Turnpike—the $5,000,000 Susquehanna River Bridge, at Harrisburg. The bridge is 4,526 feet long, 61 feet wide on the deck, and consists of 46 steel girder spans resting on 45 concrete piers and two abutments. The story of its construction is a log of modern engineering practices based on long experience.

A study of the Susquehanna River's stages showed that only between early June and mid-October would temporary construction be safe from heavy flood damage. A plan was devised to expedite temporary construction, which called for completion

Aerial view of Susquehanna River Bridge showing stages of completion from temporary construction to finished piers.



of all substructure in the river between June first and October fifteenth.

Since the solid-rock river bottom prevented the use of sheet piling, temporary construction consisted of a series of earth and rock dikes, end-dumped by truck to enclose two piers at a time. The dikes extended the width of the river, broken only by waterways, which were bridged with temporary trestles resting on rock-filled cribs.

The piers were designed with footings anchored five feet into the river's rock bottom. A solid concrete wall, running the length of each pier, extends up to highest flood-level, and each pier supports a pair of shafts which reach up to the bridge seats. The upstream ends of piers and shafts consist of rounded-nose Gothic arches; the downstream ends are semi-circular in plan, but battered upstream from bottom to top.

The intricate forms for these shapes were speedily built in Booth & Flinn's Pittsburgh shops, of welded steel shapes and wooden lagging, faced with either plywood or "Presdwood."

In the actual pouring, ready-mixed concrete was used throughout, deposited by buckets handled with crawler cranes. Extremely large pours were made to compensate for the lag between adjacent pours and expedite completion of the substructure.

Running ahead of the original schedule, the first concrete was poured on June 18, and the last pier in the substructure topped out on October 7, 1949.

Erection of the steel superstructure by the subcontracting Bethlehem Steel Company began on December fourteenth, and proceeded from both ends of the bridge toward a closure near the center of the structure on April 25, 1950.

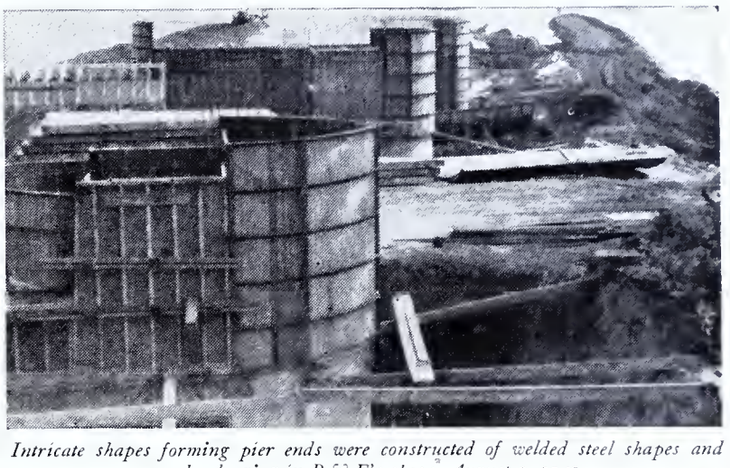
May first marked the beginning of the deck pours, and the entire deck was completed well in advance of the contract date of August 28, 1950.

For almost three-quarters of a century, Booth & Flinn Company has been engaged in construction work on bridges, highways, tunnels, foundations, railroads, industrial and marine installations, and numerous other types of heavy and light construction. The Turnpike's Susquehanna River Bridge can now be added to a long list of successfully completed projects, which includes the Holland Tunnel; George Westinghouse Memorial Bridge, East Pittsburgh; Bethlehem-Fairfield Shipyard, Baltimore; part of the Catskill Aqueduct, carrying water to New York City; and many others.

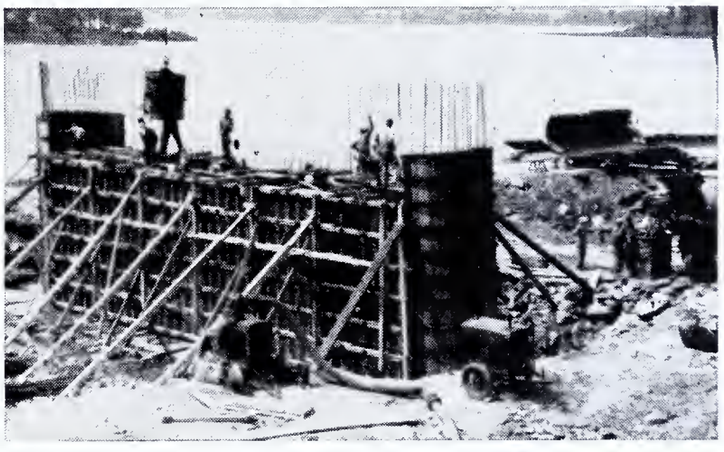
To each new contract Booth & Flinn brings the experience and techniques built up in nearly 75 years of general contracting —along with trained personnel, efficient equipment and a sound financial position.

We invite your inquiries concerning any type of construction —at any time.

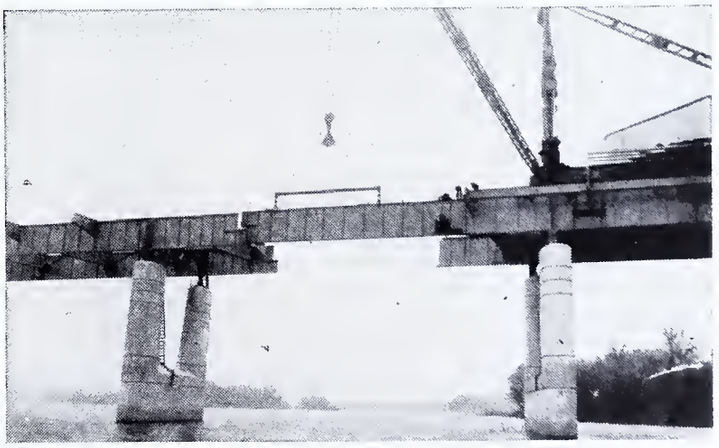
One of the series of earth and rock dikes, which were used for temporary construction. Each dike enclosed two piers. June 2, 1949.



Intricate shapes forming pier ends were constructed of welded steel shapes and wooden lagging in B & F's shops. August 2, 1949.



Ready-mixed concrete was deposited by buckets on crawler cranes; large pours speeded substructure's completion. September 9, 1949.



Bethlehem Steel erected steel superstructure, worked from both ends of bridge toward closure near center of structure. April 25, 1950.

Safety Features of Construction on Philadelphia Extension of Pennsylvania Turnpike

By Harold W. Morgan, Safety Engineer

EARLY in the planning stages of the Philadelphia Extension of the Pennsylvania Turnpike, the Turnpike Commission recognized the need of an effective accident prevention program, and, in line with a policy previously adopted in the construction of the original Turnpike in 1939 and 1940, caused to be inserted in the contract specifications pertinent references to the Rules and Regulations of the Pennsylvania Department of Labor and Industry, and Rules and Regulations of the Pennsylvania Department of Health, and the recommendations of the Associated General Contractors of America, as contained in their "Manual of Accident Prevention in Construction". In each instance the contractors were obligated to conduct all operations in accordance with the rules, regulations and recommendations as noted above. In addition, the contractors were bound to conform to such conditions as were required by the Pennsylvania Department of Highways in connection with warning signs, barricades and detours.

A Safety Department was then organized, to operate under the direction of the Chief Engineer, and to be supervised by a Safety Engineer in the Central Office at Harrisburg. Assistant Safety Engineers were then appointed and assigned to the respective districts on the extension. The Safety Engineer's duties required general supervision over all safety activities in all districts, while each Assistant Safety Engineer made daily safety inspections of all contracts in his district, reporting directly to the Safety Engineer. To facilitate the daily safety inspections, the Commission furnished individual transportation to the Safety Engineer and his assistants, thereby enabling them to quickly reach any point on the line at which an emergency might arise. Working time for the Assistant Safety Engineers was made to coincide with that of the contractors, in order to ensure maximum safety control over all operations. In order to further strengthen the inspection program the Assistant Safety Engineers were required to furnish the Safety Engineer with a minimum number of reports, thereby reducing the time which might necessarily have to be spent in the office, consequently increasing the time spent in making safety inspections in the field.

Following the adoption of the centerline, and after plans for each contract had been completed, a close survey of all

physical features was made. The location of all cuts and fills were noted, and any inherent or potential hazards were noted. This survey included a study of the soil and sub-strata as determined by core borings with reference to water-bearing qualities or greasy consistency which might possibly result in causing heavy equipment to slide. Hard rock areas were carefully examined in order to determine the type and amount of blasting to be done. The location of all overhead electric power lines was noted, and heights above operating levels were determined so that preventive measures might be applied while cranes or shovels were operating at these points. Locations of all underground cables, conduits and pipe lines were determined, and each highway, road, railroad or stream crossing was carefully studied in order to apply the proper protective measures. This information was of particular value when operations commenced, in that the Safety Department was in a favorable position to warn the contractors of any possible contingencies. Likewise, studies were made at bridge sites where the Turnpike crossed the Susquehanna River and the Yellow Breaches and Swatara Creeks, as well as at sites of lesser bridge structures. In each case, the proper accident prevention methods were applied by the contractors. Where necessary, power boats equipped with life-belts were used for transportation of personnel, and "hard hats" were used on the construction of all steel structures.

Immediately following the award of contract and the issuance of the notice to proceed, each job was posted with signs relating to the compensation laws, while trespass and warning signs were erected at job sites or in advance of job locations in order to warn the general public of the existence of a potential hazard. The contractors then advised the Department of Health of the location of the proposed source of supply of drinking water, and after inspection of the source and an analysis of the water, the contractor was advised as to the acceptance or rejeetion of the source of supply. The manner of dispensing the drinking water then became the direct concern of the Safety Department, and each contractor was obligated by law to dispense the water in sanitary closed containers and individual drinking cups. Location diagrams and plans for explosives magazines were submitted by the contractors to the inspection department of the Department of Labor and Industry, and upon approval, the storage, transportation and use of the explosives came under the jurisdiction of the Safety Department. All temporary run-arounds and detours at bridge sites were protected in accordance with standards which were approved and adopted by the Turnpike Commission and the Department of Highways. In order to become fully acquainted with all phases of work, each job was studied closely as operations commenced, and tools and equipment were examined to determine their practicality, mechanical condition and method of operation, while operational methods and procedures were followed through to locate any inherent or potential hazards.

As the contractor's operation spread along the line, daily safety inspeetions were made, and as each job site was visited, appropriate criticisms were pointed out to those in charge, and immediate correction or removal of hazards was requested. We are happy to state that in the majority of cases instant compliance was had, and the Safety Department seldom had to appeal to higher authorities for assistance in enforcing safety regulations. One of the greatest faetors in safety inspections is the ability to recognize a hazard, and once recognized, to be in a position to recommend the proper type of correction. This ability must not only be possessed by the Safety Engineers, but by superintendents and foremen as well, as the work is being done directly under their supervision at all times and they

(Continued on Page 182)

Highway Yardstick--For Peace or War

By Lt. Gen. Eugene Reybold
Executive Vice-president, American Road Builders' Association

IT USED to be military tradition that an army traveled on its stomach.

World War II completely exploded that dictum. For, while that great conflict didn't ignore the food requirements of its participants by any means, it did throw a brilliant spotlight on mobility as a critical feature in military successes. Mobility of manpower, of fire power, of supplies, of foods, of medical assistance, of communications, of engineering equipment and needs and of the vital supplies that kept at full speed the greatest production miracle the world has ever known, were brought home to us constantly. Those of us who were privileged to play key parts in waging the campaign always had to plan in terms of mobility.

It was that same mobility that gave the vaunted German panzer divisions their fearsome striking force and which paved the way for the early Nazi successes. The "autobahns" which the Germans had built in time of peace served them well when Hitler's legions finally were unleashed to swing into Europe in search of "lebensraum." And so important did the Germans consider their high speed superhighways to the success of the forward drive any enemy might have, that when the tide of the war against them became evident, they deliberately destroyed bridges and other key facilities along the "autobahns" to deny for as long as possible the effectiveness of those traffic arteries to our attacking forces. As it happened, the time we had to spend reconstructing those facilities was not enough to turn the tide of battle against us—as the Germans had hoped.

We in America had never planned our highway transport as carefully for military purposes as had the Germans. We were, after all, a peaceful people interested mainly in providing the arteries of communication our motoring habits and our road transportation system demanded. When war came, as a result, we were caught with precious little of the "autobahn" type of mileage. And that which was in existence, principally and probably most importantly the 160 miles in the original section of the Pennsylvania Turnpike, had been planned for peaceful purposes.

Certainly the session of the Pennsylvania Legislature which set up the Turnpike Commission in the waning years of the depression '30's had no way of knowing that any highways the commission might build would shortly be called upon to play a war role. Certainly when the highway was completed and placed in service on October 1, 1940, the gathering war clouds—while growing ominously darker—had not neared the "at war" stage.

Fortunately for this nation, the failure to coordinate highway planning for peace with possible military needs wasn't fatal. Because there was no actual conflict fought on American shores, the highway

deficiencies which had begun to become critically apparent even then weren't sufficient to halt the movement of troops and supplies.

When war did come, one of our best, if not the best highway facility lay in Pennsylvania's turnpike. Patterned largely after the German "autobahns," which had been studied first hand by Commission Chairman T. J. Evans prior to start of construction, the Pennsylvania Turnpike "went to war" with brilliant effectiveness. True, its standards were a little more modest than those of the "autobahns"—two 24-foot lanes in each direction separated by a 10-foot median strip compared with two 27-foot lanes each way separated by a 20-foot median strip in the case of the "autobahns"—but its record of service was nonetheless outstanding.

It wasn't long until 95% of all trucking between the Midwest and East passing through the area served by the Turnpike was using that road. It wasn't long before 21 million pounds of freight per day—10,500 tons—were moving by truck over the Turnpike. And 85 per cent of that total was essential war material. The Turnpike was soon found to be supplying an amazing extra factor of mobility that lopped precious minutes, hours, days and even months off the total span of the war.

In addition to that factor of mobility, the Turnpike was making still another contribution. It was saving truck transport an average of five hours of driving

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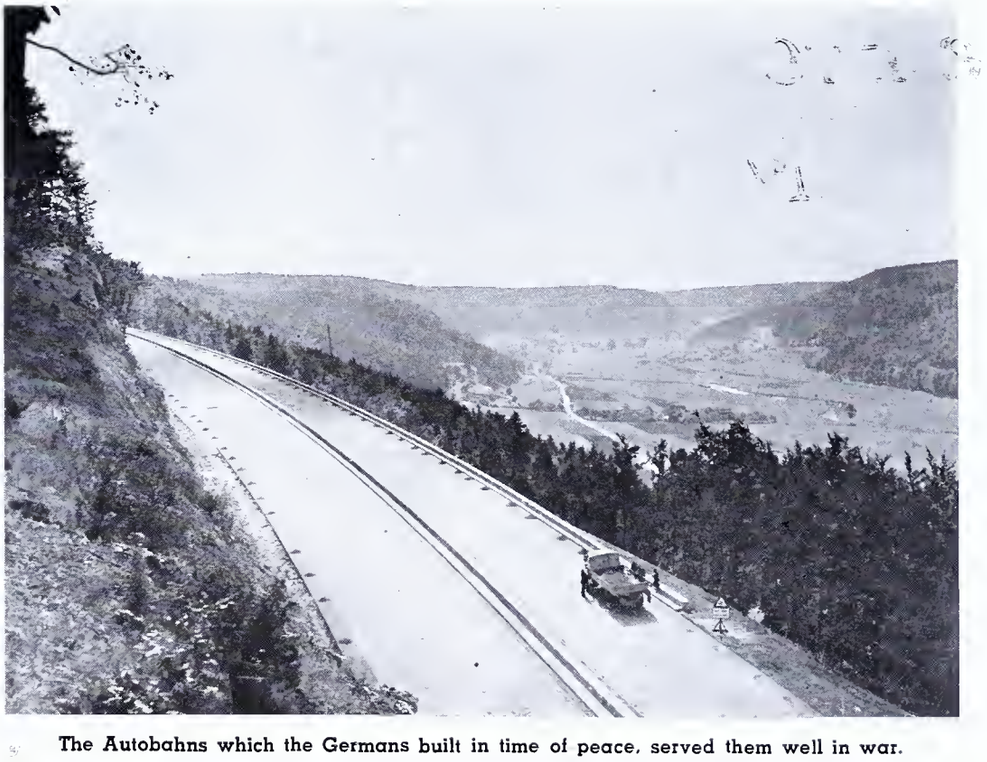
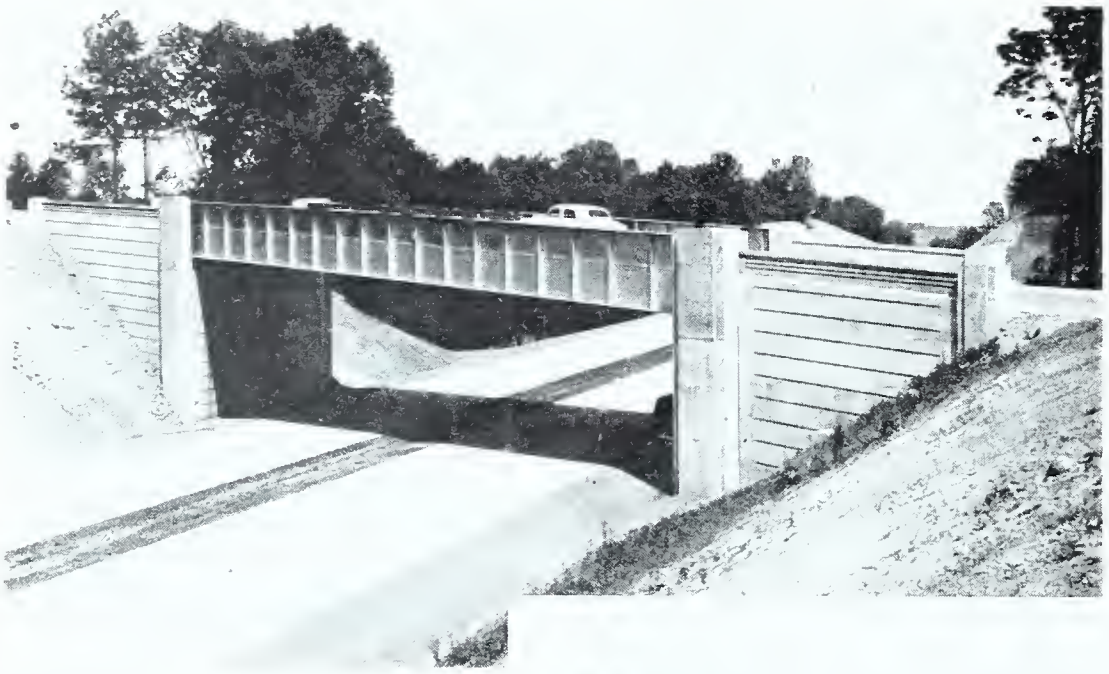


The Autobahns which the Germans built in time of peace, served them well in war.



Above: CONTRACT 209, Dauphin County. Section 23-A, 4.66 Miles; $2,509,828.49.

Right: CONTRACTS 227 and 228, Berks and Chester Counties. Section 26-C, 3.8 Miles and Section 27-A, 4.62 Miles, $3,707,788.04.

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Turnpike Impetus To Growth and Prosperity of Pennsylvania's Commerce

By Theodore Roosevelt, III, Secretary of Commerce Commonwealth of Pennsylvania

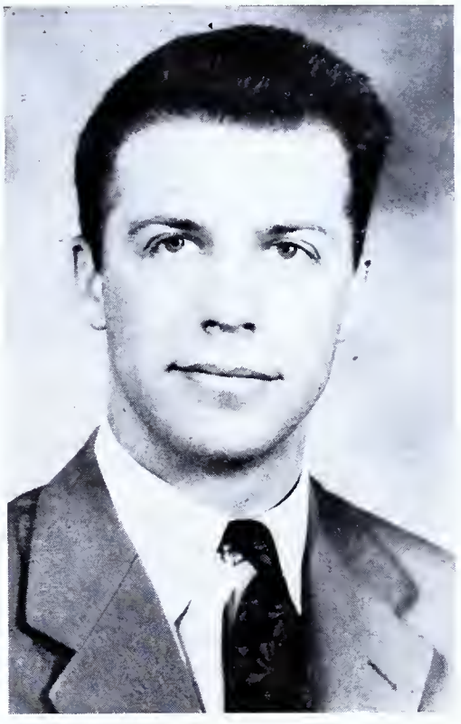
PENNSYLVANIA has always been a pioneer in the field of transportation, but the building of the Pennsylvania Turnpike as a cross-state superhighway is one of the most important pioneering developments ever undertaken in this Commonwealth.

Completion of the Turnpike from Philadelphia to our western border will, for the first time, solve a basic problem which has plagued every effort to develop the full growth and prosperity of Pennsylvania as a colony and as a state.

From the earliest days, the Appalachian Mountains have been a natural and formidable barrier which has hampered east-west commerce in Pennsylvania. These ridges, which add so much to the natural beauty of the State, formed a hurdle which travelers had to climb over or seek to avoid by a very circuitous route.

The canoeist, the trader traveling afoot with pack on back, the pack train, the Conestoga wagon, the stage coach, the canal boat, the railroad train, and the motor vehicle in turn struggled through this rugged terrain. Each found the mountain ranges, although not actually a bar, at least a hindrance to commerce and progress.

For two centuries repeated efforts have been made to conquer this obstacle to easy communication between the Atlantic seaboard and the Ohio country. In 1758, to supply his successful expedition against Fort Duquesne three years after Braddock's defeat, General Forbes' men cut a rude road through the mountain wilderness and thereby established a wagon trail westward to Pittsburgh. In 1834, with waterways in use on each side of the Alleghenies, the Portage Railroad was completed to carry canal boats over the mountains between Hollidaysburg and Johnstown and (with the Pennsylvania Canal and the Philadelphia-Columbia Railroad) form a rail-water route from Philadelphia to Pittsburgh. A century ago the Pennsylvania Railroad was building its lines over the mountains west of Altoona, leading to the first all-rail route across the State in 1853. Since 1911, when the modern period of state highway construction began, Pennsylvania has built a system of motor roads unequalled by any other Appalachian state, with many excellent highways criss-crossing this Commonwealth's mountainous midriff.



Each of these accomplishments brought vast improvements in cross-state travel. Each offered a new and faster way to climb over the Allegheny hurdle, but none was able to escape the handicapping necessity of forcing traffic to creep over mountain after mountain. Even with the development of swifter and more powerful carriers of passengers and freight, operators of many vehicles regarded this climb as tedious, slow and costly even when there was no icy weather. Some continued to seek to avoid the up and down grades by following circuitous routes, and much commerce was lost to Pennsylvania and its excellent seaport at Philadelphia.

Finally, a decade ago, Pennsylvania amazed the world with a radically different type of highway which kept the roadbed virtually flat even in a nestful of mountains. In 1940, it dedicated the Pennsylvania Turnpike which in 160 miles eliminated 10,000 feet of climb by going *through* the mountains instead of *over* them. In addition, the new road was four lanes, with divided traffic and long, sweeping curves. There were no intersections, no red lights, no pedestrian crossings, and no other hindrances to continuous high-speed travel. It was the "dream highway" such as drovers, teamsters, canalboat men, and truckers must have dreamed of for two centuries. Instead of being the most slow, tedious, and costly portion of a long haul, Pennsylvania's mountain country overnight became the fastest leg of the trip and the one most easy to drive.

But even building a super-highway at "near water-level" under the mountains was not a sufficient answer to the ancient problem of swift and easy communication between tidewater at Philadelphia and the Ohio and Mississippi basins. The new Turnpike merely fed additional thousands of vehicles on each side of the mountains into highways already inadequate to carry the volume of traffic which choked them. Trucks leaving the eastern terminus of the Turnpike still were separated from the markets and piers of Philadelphia by 100 miles of thickly populated territory, and traffic congestion and bottlenecks were almost constant in urban areas and on the open road. The western end of the Turnpike also lacked access and dispersion routes capable of expediting the growing caravans through the heavily industrialized valleys.

The result was that while the Turnpike's Appalachian underpass had eliminated the tedious and slow climb of mountain driving, the man at the wheel found it had merely substituted the tedium and slowness of bumper-to-bumper driving for many miles on either side of the super-highway.

It remained for the vision and "do something" policy of Governor Duff to tackle this dilemma. It was he who pushed to reality the extension of the Turnpike to the east and the west to expedite the traffic to which the tunnel route had proved such a boon. Simultaneously he has been pushing construction of toll-free expressways to provide modern routes for traffic in many of our congested urban centers; and the strategic location of interchanges will connect the Turnpike with some of them.

Thus, the completion of the Turnpike extensions will give Pennsylvania a low-level modern express cross-state highway for safe, fast and easy communication between the Atlantic seaboard at Philadelphia and the industrial and agricultural empire west of the mountains. It will be the first time that such a barrier-free route will be available, although its need has been felt since the first push of colonial expansion westward from Penn's "greene countrie towne" on the banks of the Deleware and Schuylkill. It also will provide high-speed transport east and west for many of Pennsyl-

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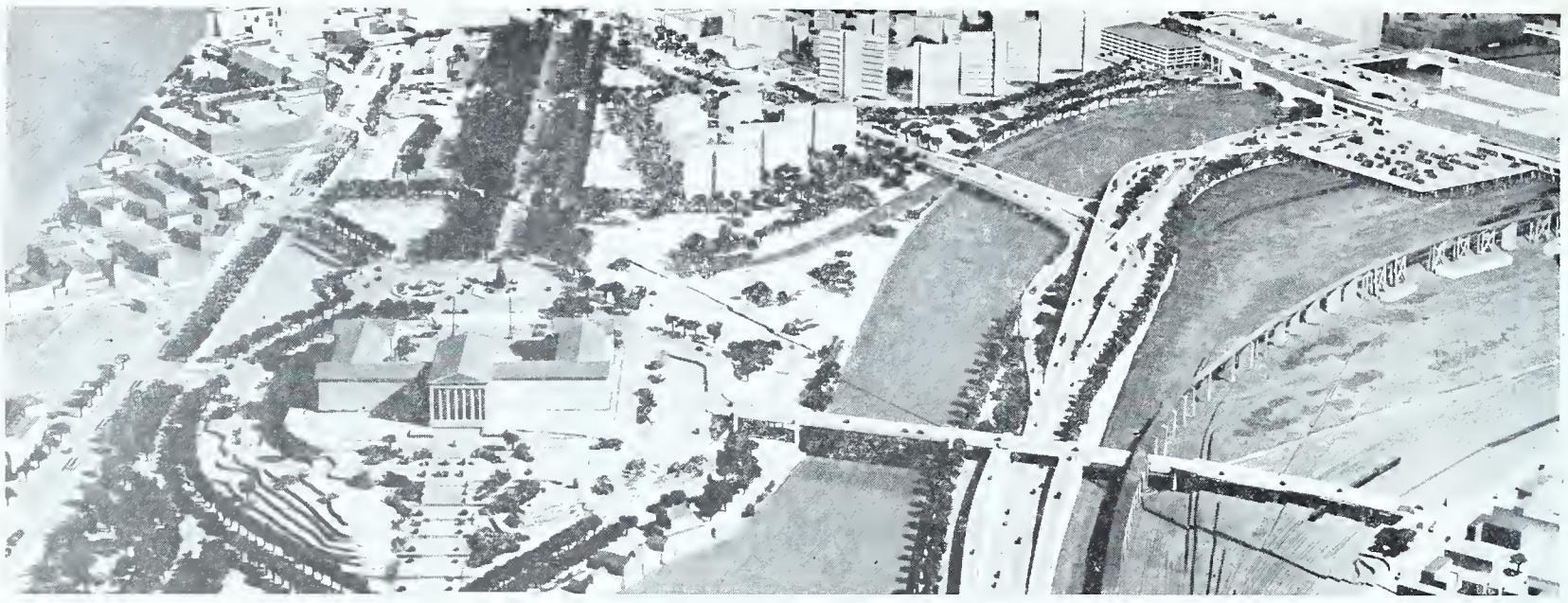


Proposed Schuylkill Expressway approaching the heart of Philadelphia with a new Vine Street Bridge and extension making all parts of Central Philadelphia easily accessible.

Philadelphia's Highway Plans and Their Relation to the Pennsylvania Turnpike

By Edmund N. Bacon, Executive-Director Philadelphia City Planning Commission

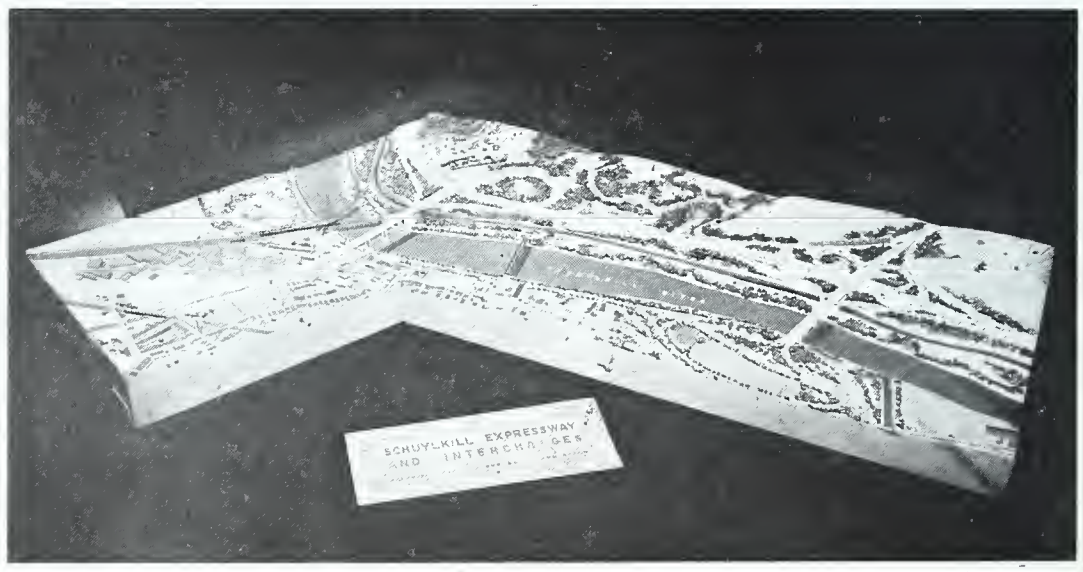
THE CONSTRUCTION of the Eastern Extension of the Pennsylvania Turnpike has accellerated the planning of Philadelphia's comprehensive highway system.

Well before there was any public announcement of the proposed Extension, the Philadelphia City Planning Commission had prepared a tentative plan for a regional expressway network. This vast and costly plan was regarded by some as an ivory tower dream, but as soon as the extension was announced, its usefulness became apparent. Today, with the completion of the first phase engineering plans for the $77,000,000 Schuylkill Expressway and its connections, and preliminary planning work on the Delaware and Tacony Creek Expressways, the greater part of the plan is now on the drawing boards.

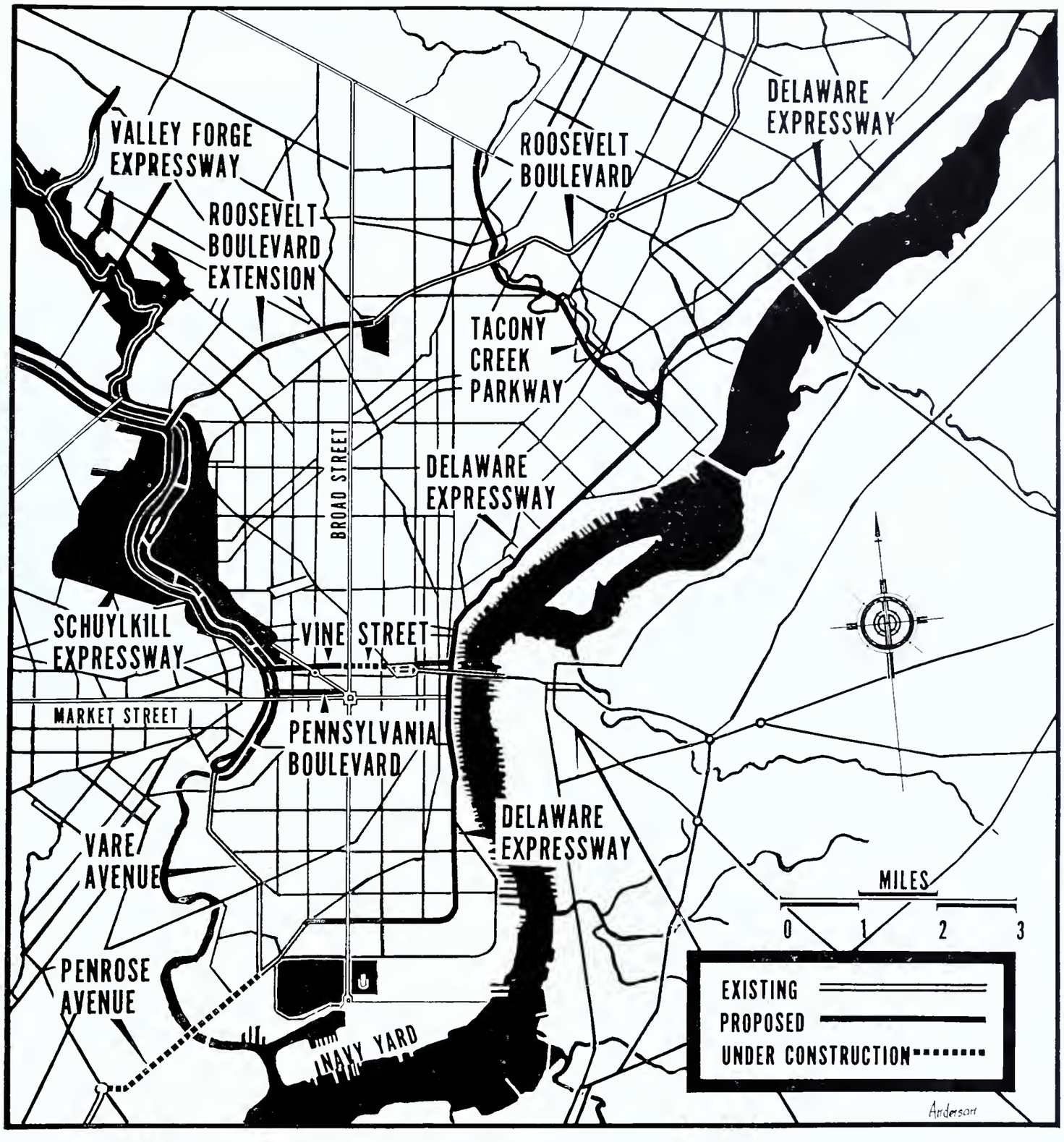
The need for an expressway connection between the eastern terminus of the Turnpike and Philadelphia, and proper connections between the Expressway and Philadelphia's arterial highway system, existing and proposed, was immediately recognized by the State Highway Department. In 1948, Mr. E. L. Schmidt, Chief Engineer of the State Highway Department, entrusted to the Philadelphia City Planning Commission the responsibility for preparing first phase engineering drawings for the Schuylkill Expressway connecting with the State planned artery from the City to King of Prussia, and connections to widened Vine Street leading to the Delaware River Bridge, to Roosevelt Boulevard, main artery to Northeast Philadelphia and to points north.

The new development required a restudy of the comprehensive Expressway system. The complex network was reduced to its barest essentials. Where possible, two routes were combined into one. A cellular type of system was evolved, based primarily on diagonal expressways with "T" interchanges. Each expressway link served traffic in several directions. The highways are less direct for many movements than would be a more complex system, but distance is of secondary importance on an expressway. The final pattern, in the opinion of the Commission, serves all parts of Philadelphia, with a minimum mileage of road to be constructed. Basically, it consists of arteries paralleling the Schuylkill and Delaware Rivers, with Vine Street serving as the central city connection. The Roosevelt Boulevard and its extension and the Tacony Expressway provide a circumferential route to the north and also act as feeders to the two arteries to central city. (See Illustration 1.)

This basic scheme, which is a distillation of the more elaborate earlier plan, served as an essential base in all of the detailed planning of the Schuylkill Expressway, and gives Philadelphia a definite long range goal for solving the



Model of Schuylkill Expressway along west bank of Schuylkill. Right leads to Valley Forge Expressway: left front: Roosevelt boulevard extension.



Map of Philadelphia's expressway system showing existing and proposed sections, as well as those under construction. Schuylkill Expressway, including Roosevelt Boulevard and Vine Street extensions, probably will be finished in six years; tentative date for completion of balance is 1970.

traffic problem. When completed, it will provide Philadelphia with as fine a circulatory system as any in the United States.

All of the plans were developed in closest cooperation with the Department of Public Works, the Traffic Engineering Bureau of the Department of Public Safety, and the Pennsylvania Department of Highways. The Commission's Technical Advisory Committee on Local Transportation reviewed every detail of the plans and made many valuable suggestions. The plans were discussed with such organizations as the Chamber of Commerce, the Citizens' Council on City Planning, and community associations.

The result is a plan for highways the way Philadelphians want them, and in accordance with Philadelphia's needs.

The largest Origin and Destination traffic survey ever carried out in the United States was recently completed jointly by the City, the States of Pennsylvania and New Jersey, and the Federal government, covering the Philadelphia Metropolitan Area. It was brought into use in the design of the Schuylkill Expressway, the Roosevelt Boulevard Extension and Vine Street Extension — the first expressway links in Philadelphia's comprehensive highway system. The 500,000 recorded vehicular movements were analyzed, and the expected traffic movements on the various sections of the

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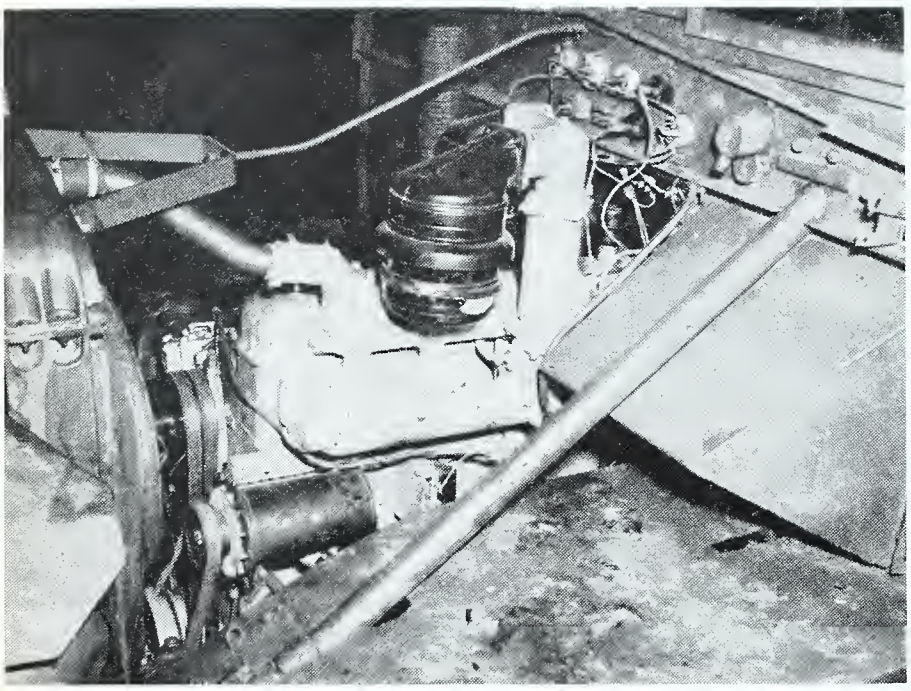
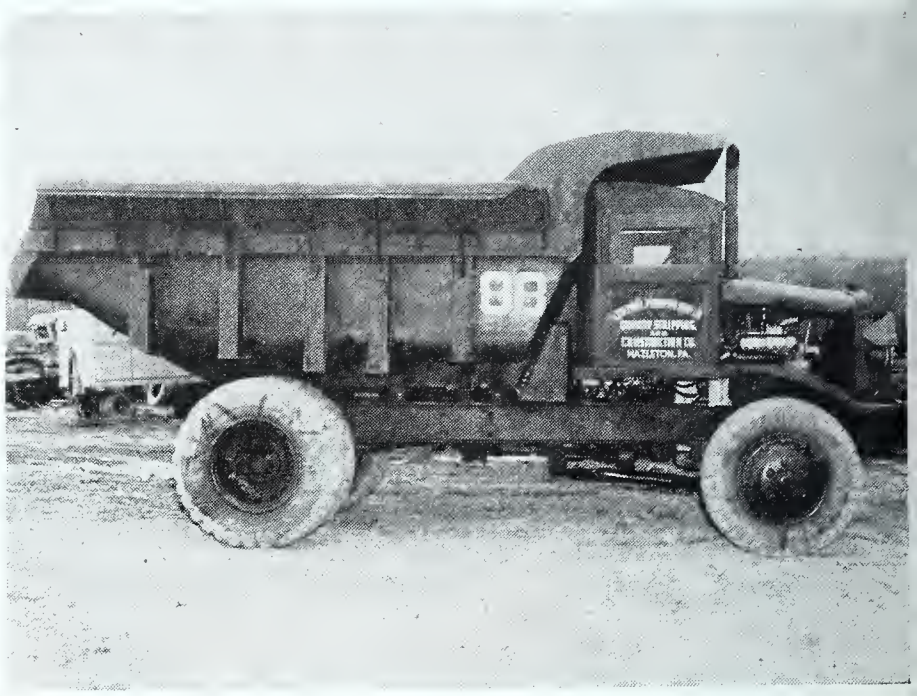
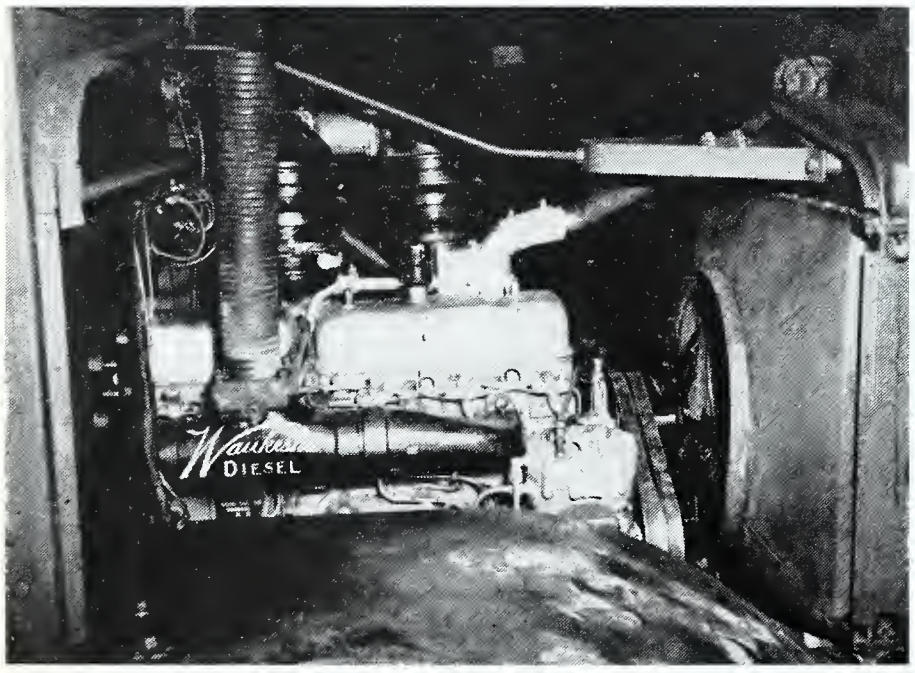
Waukesha







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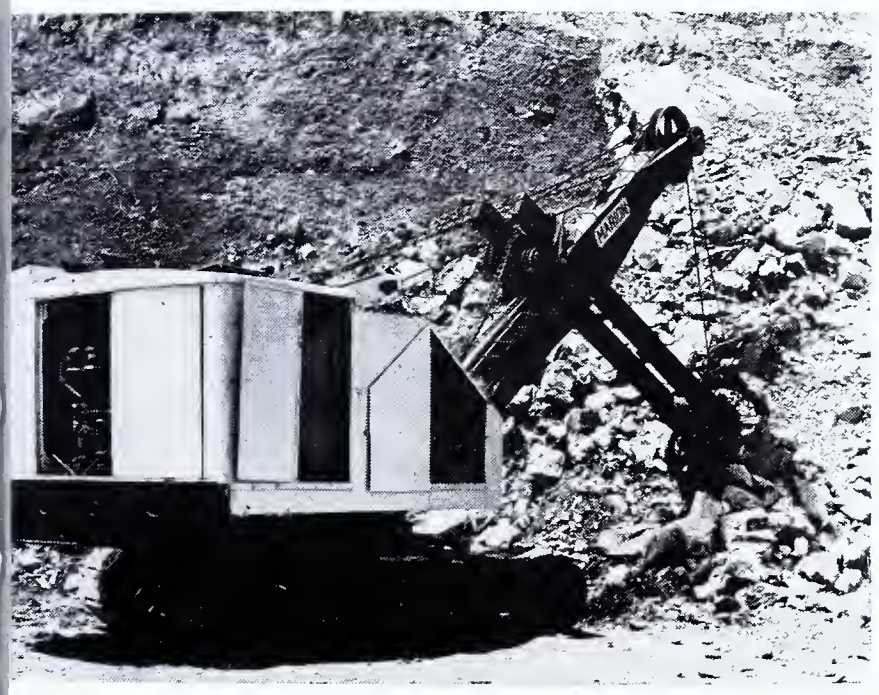

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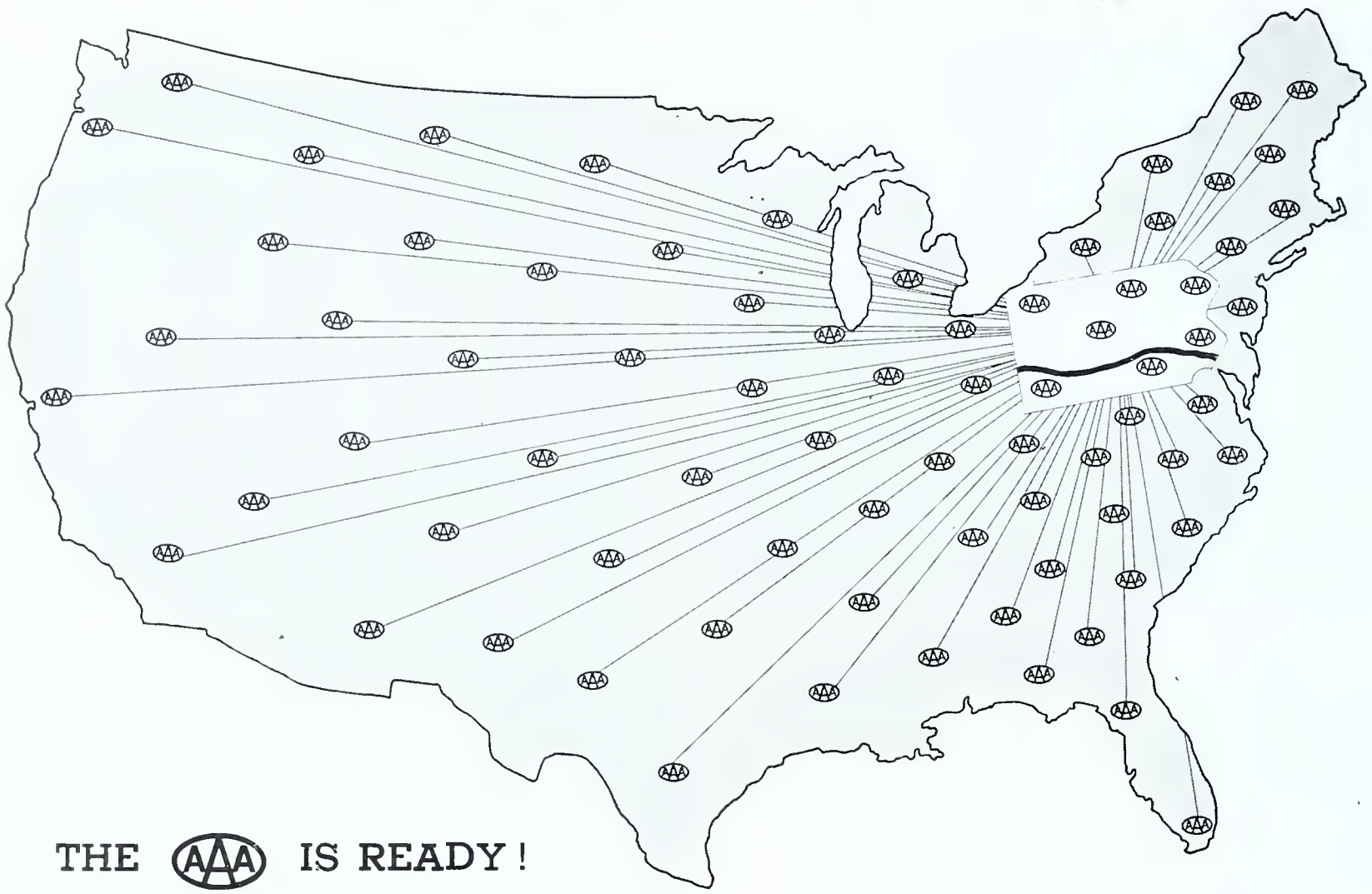

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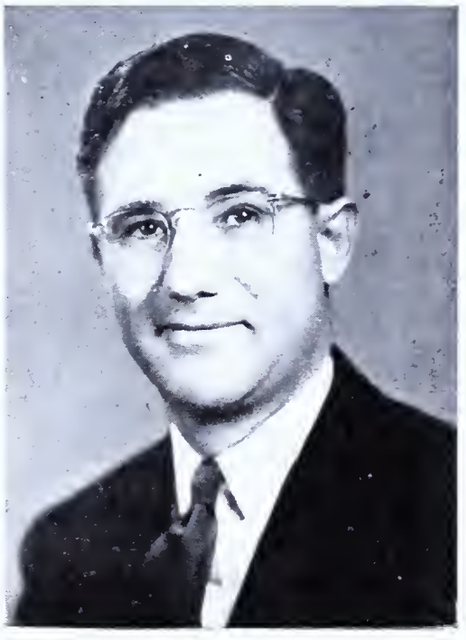
A. P. C. President Lauds Turnpike Commission and The Contractors

By
DONALD B. STABLER
President
Associated Pennsylvania Constructors



DEDICATION of the Philadelphia Extension of the Pennsylvania Turnpike provides a welcome opportunity for me to congratulate the many, many persons who have particpiated in this marvelous highway project.

The Philadelphia Extension is an achievement of such magnitude that everyone can share in the pride of accomplishment. Members of the Turnpike Commission deserve the highest commendation for projecting and completing this useful traffic artery as part of what is rapidly becoming a system of super-highways. Governor Duff demonstrated vision, sagacity and leadership in providing this needed transportation facility for Pennsylvania.

Of course, it is with unusual pride that I congratulate the heavy construction industry for building the Philadelphia Extension. Our industry's accomplishment is further proof that no task is too big for the ingenuity, initiative and enterprise of American contractors.

Only the very highest praise is due the host of engineers, specialists, manufacturers, distributors and material dealers whose coordinated efforts played such an essentially important part in transplanting plans into one of the world's greatest highways.

It was a great privilege for Associated Pennsylvania Constructors to play an important role not only in promoting the Philadelphia Extension but also in facilitating its construction. Our Association has been signally honored in publishing this special Dedication Number of our official publication, HIGHWAY BUILDER, to celebrate and record this achievement of highway construction.

For nearly two decades Associated Pennsylvania Constructors as an organization has occupied a key position in the development of the Pennsylvania Turnpike System. As far back as 1935 our Executive Secretary was pioneering in selling the idea of a great super-highway across Pennsylvania. Through the columns of HIGHWAY BUILDER this idea was promoted and discussed when only a handful of people realized its possibilities — and many scoffed and ridiculed the project as impossible.

Over the years Associated Pennsylvania Constructors has been proud to enjoy the confidence of the Turnpike Commission and to cooperate consistently and willingly in the development and expansion of the Turnpike System. When the original section of the Turnpike was completed HIGHWAY BUILDER had the honor to publish a special number that today remains an invaluable hand-book and reference volume. When the Philadelphia Extension was projected, our Association again extended all of its facilities to the Commission, and has been a strong arm to those responsible for its construction.

This is the place to emphasize that the job is not done. The Western Extension of the Turnpike is still under construction, and plans are in the making for construction of other sections to link the main east-west artery with different parts of the State. Associated Pennsylvania Constructors will continue in every possible way to assist the Turnpike Commission in finishing work already under construction in the western part of the State — and then promote tributary links that will provide a Turnpike System pre-eminent in all the world.

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Center Strip—Looking Southeast Towards Mechanicsburg.

Eastern Extension of Pennsylvania Turnpike System

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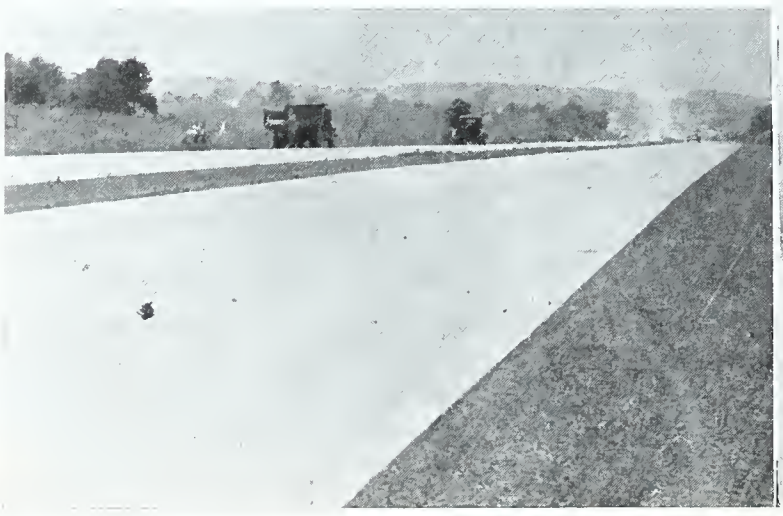

Rigid Frame Bridge.

The Importance of a National Turnpike System

By Col. E. R. Needles, President
American Road Builders' Association

MY very intense interest in turnpikes stems from two things—the fact that I am an engineer who sees in the level of turnpike construction engineering design and practice reflecting great credit on my profession and the fact that I am serving as elected head of the country's oldest national good roads group, the American Road Builders' Association.

As an engineer, I am gratified by the contribution members of my profession have made, are making and will continue to make as a national system of high speed, limited access highways comes into being.

As a member of the highway industry and profession and a long-time participant in the American good roads movement, I know, too, just how great a contribution such a network of roads can make to the national economy, welfare, safety and defense.

On this occasion—the dedication of the 100-mile eastward extension of the Pennsylvania Turnpike, the "grandaddy" of all such modern-day thoroughfares—we may well pause to reflect on the crisis on America's highways and the alleviation of that crisis to which we must all dedicate ourselves.

We've reached a point in our highway picture that is fantastically and discouragingly critical. Over the years, we have invested a total of $35 billion in a highway network for the nation. Basically, we have the best network of roads and streets the world has ever known. We have had to develop such a network because of the impact the automobile has had on the American way of life, an impact so great that the 20th century undoubtedly will go down in the record books as the Century of the Motor Vehicle.

If there is one item at this mid-century mark which more than any other material thing symbolizes life in these United States, it is the automobile. We Americans own far more than twice as many motor vehicles as the rest of the world combined—more than 44½ million of the world total of 62½ million.

American families spent more last year to buy and drive automobiles than for any budget items except food, housing and clothing. For motoring, they spent four times more than their combined outlay for doctors, dentists, telephones,

radios, religion, movies, books, magazines, newspapers and private schools.

Highway transportation has become such a major foundation stone of our national economy that one-seventh of the nation's entire income is derived from its many facets. From our $35 billion highway investment, we are reaping a yearly dollar harvest of $30 billion in national income. That figures out to a return of 86 cents each year for every dollar invested in highways throughout the years.

It is no wonder that no other country in the world can match our road and street network. But that patent superiority of our highways has gotten us into hot water, water that is getting hotter by the minute and which is being heated by a seemingly endless supply of fuel—motor vehicles. We have either become blinded to the fact that our highways still are nowhere near good enough or, worse yet, have committed the shortsighted blunder of sweeping a serious problem under the rug.

The problem—and it is getting more acute every day—is simply that our use of the motor vehicle has far outstripped the highway construction program. We are the victims of a progressive degeneration of our roads and streets that dates back about two decades, when we first allowed motor vehicle production to run away from highway improvement. These companion components of our economy—cars and highways for them to use—grew almost simultaneously from right after World War I until 1930. There the growth similarity ended. We acted like parents with twin boys who suddenly began to stuff one son with all the food he could hold, but denied the other more than enough food to keep the spark of life aflame.

We were still doing that when World War II hit. Pearl Harbor precluded for the duration of the war anything beyond bare-boned maintenance of such highways as we possessed. We came out of the war with a highway system largely built for much slower vehicles and much fewer of them than we have today. After stuffing one of our twins for 15 years, exclusive of the war years when auto production was at a standstill, and stepping up that stuffing for the last five years (when the motor vehicle count zoomed upwards by 14½ million vehicles), we today find ourselves wondering why the emaciated twin's clothes won't fit his overfed brother.

We find ourselves facing a situation in which neglect of our highway "plant" has permitted accumulation of deficiencies of $41 billion. We are faced with the knowledge that if it takes us as much as 10 years to overcome those deficiencies, the growing traffic volume and mechanical improvements in motor vehicles will show up another $14 billion in deficiencies. And we know that at our present rate we have fallen so far behind in building adequate traffic arteries and our rate of progress in this respect is so utterly woeful, that we are not even holding our own, let alone making a start toward catching up with the backlog.

Last year provides a simple but graphic example. We spent a record $1¾ billion in 1949 on highway construction and reconstruction. During the same 12-month period, the nation had a net increase in motor vehicle registrations of 3,533,550. Place those new cars bumper to bumper, and they would occupy almost exactly the number of miles of highway the nation bought with its $1¾ billion. In effect, we merely bought parking space, not driving room, for these new cars, trucks and buses.

To overcome $55 billion of highway deficiencies in a ten-year period, annual expenditures of 5.5 billion are needed in the decade. In the face of that docu-

(Continued on Page 148)

COMMONWEALTH OF PENNSYLVANIA
DEPARTMENT OF HIGHWAYS
HARRISBURG

CHIEF ENGINEER

August 9, 1950

The Editor
HIGHWAY BUILDER
Third and State Streets
Harrisburg, Pennsylvania

Dear Sir:

As Chief Engineer of the Pennsylvania Department of Highways it has been my duty to follow closely the location, preliminary planning, final design, and construction of both the Eastern and Western Extensions of the Pennsylvania Turnpike and on many occasions to proxy for Honorable Ray F. Smock, Secretary of the Department of Highways, who is an ex-officio member of the Commission.

In my association with the Commission, its engineering staff and consulting engineer, I have found them most cooperative and I wish to commend them all on a job well done.

Sincerely yours,

E. L. Schmidt

E. L. Schmidt
Chief Engineer

Turnpike Commissioner Praises Cooperation

By James J. Coyne, Commissioner
Pennsylvania Turnpike Commission

IT HAS BEEN for me a great privilege and honor to have served as a member of the Pennsylvania Turnpike Commission while the plans for the engineering and the financing and construction of the two Extensions were aetually being carried out.

To successfully plan and execute such a huge undertaking requires the utmost in cooperation from all the various and neeessary professional, financial, industrial and labor groups. This cooperation has been enthusiastic and every man who had anything to do with the construction of the Pennsylvania Turnpike and its two Extensions may well be, and I believe is, proud of the opportunity for such service.

When I first became a member of the Commission in 1943, we were operating a losing venture. Operating income was less than costs because of tire and gasoline rationing during the War.

But we had confidence in the Turnpike and knew that when these war-time restrictions were lifted that it would become onee more a successful operation.

When the two extensions are completed and become a part of the Pennsylvania Turnpike System, some new words will have to be invented to adequately describe it.

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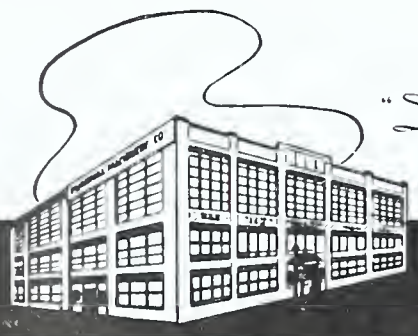
The completion of the Pennsylvania Turnpike's Eastern Extension marks another "mission accomplished" in which we take pardonable pride; for Furnival Machinery Co. furnished the equipment you see pictured above—as well as that of the firms listed at the left. Perhaps your next job will not be as large an undertaking as the Turnpike, but you will certainly want it accomplished in as thorough and dependable a manner. Why not let us furnish you with any details regarding sales, rental, service or parts? An inquiry will bring our prompt reply—and there is no obligation on your part, of course.



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The Turnpike Crosses The Susquehanna

By Maurice N. Quade, Partner
Parsons, Brinckerhoff, Hall & Macdonald, Engineers, New York

ONE OF THE three largest rivers that the Pennsylvania Turnpike must cross in traversing the State of Pennsylvania is the Susquehanna. It is a broad, normally very shallow river that is quite capable of rising to a flood stage of nearly 30 feet above low water. The site of the crossing is about 5 miles downstream from the City of Harrisburg. Its eastern terminus is less than 60 feet north of the Steelton-Highspire boundary, which is also the approximate southerly limit of the Steelton plant of the Bethlehem Steel Company.

The location of the western approach to the bridge is determined by the topography, the principal feature of which is a 250 foot high ridge which meets the river downstream from the bridge site. The approach follows the north slope of the ridge for some distance west of the river along a side-hill cut of unusually large proportions.

The location of the steel plant on the east shore and of the ridge on the west shore fixed the alignment within narrow limits and the crossing is unavoidably on a skew which increased its length above that of a normal crossing at the narrowest part of the river by approximately 700 feet. The distance between low water shore lines on the bridge alignment is about 3,650 ft.; 450 ft. of this length is a crossing over Calver Island near its downstream end. Most of this island is submerged at extreme flood stages of the river.

The main east-west line of the Pennsylvania R. R. parallels and is located on the east bank of the river. Further inland are several other tracks which necessitated locating the east abutment about 650 feet from the shore line. On the west bank and parallel to it are four main-line tracks of the York and Baltimore division of the railroad. These tracks, as well as the four main tracks on the east shore are electrified. On both sides of the river the railroad tracks are only one foot above the record high water stage during the 1936 flood that reached a stage of approximately Elevation 308.5 at the bridge site.

The elevation of the bridge roadway was governed at the east end by the minimum structure clearance of 23 ft. required above the top of rail on the main tracks; at the west abutment it was governed by the approach roadway and is slightly higher. The grade is constant throughout the entire length of the bridge and is only 0.23 percent. The difference in elevation at the center line of bearings on the abutments, which are 4526'-0" apart, is 10.41 ft.

Navigation on this part of the river is limited to small pleasure boats and shallow-draft, flat-bottomed scows that are propelled by shallow, stern paddle wheels. The principal factor governing the length of spans and their height above water is not navigation but the flood conditions in the river and the railroad clearances. It was obvious from the beginning that the piers would have to be skewed, but the two shore lines are not parallel by about 25 degrees and the question to be determined was whether more than one skew angle would be required. Further evidence indicated that at flood stage the currents are nearly parallel to the east shore and all piers in the river are made parallel to that shore. By fortunate coincidence the skew angle of the shore line is within 30 minutes of the angle formed by a bevel of 3 on 12. The adoption of a skew of 3 on 12 was undoubtedly received with enthusiasm by every detailer and draftsmen in the fabricator's drawing room. The skew angle of the west shore is about 36 degrees (a bevel of 9 on 12). Had it been necessary to place the piers west of Calver Island on this skew, the cost would have been increased by $175,000 due, of course, to the greater transverse length of the piers and the west abutment and the additional structural steel required largely for the longer skewed expansion joints.

Extensive borings indicated that satisfactory rock is located a few feet below the bed of the river throughout its entire length and the island crossing. The rock is much harder and at a higher elevation near the west end. In feet, it is exposed on the bed of the river at depths of 1 to 2 feet below low water stage near the west shore. Near the east shore the rock is softer and slightly deeper, with a few feet of overburden on top of the rock surface occurring mostly throughout the water at low water stage (water surface Elevation 282) is about 5 feet. The lowest elevation of any of the pier bases is 272 — a depth below low water of only 10 ft. The piers and east abutment adjacent to the railroad tracks on the shore are founded on spread footings having a maximum bearing of 5 tons per sq. ft. at depths of 9 to 15 feet below ground level. Rock in that vicinity is at a lower elevation than beneath the river and is about 35 feet below ground.

The presence of rock at shallow depths and the relatively low piers (maximum height 56 ft. overall) made it rather obvious that the economic span lengths for the river crossing would be in the vicinity of 100 ft. and that continuous spans would be economical. Our first layout was based on 96-foot spans in the east channel and 107-foot spans in west channel. This was found to be the lowest cost of all layouts studied. However, the Pennsylvania Water and Power Resources Board indicated that they would not approve for hydraulic reasons span lengths having less than a 100-ft. clear distance between piers. We therefore prepared a second layout which consisted of 109-ft. continuous spans except for a unit of 120-ft. spans at the west end to provide sufficient clearance for the P. R. R. tracks on the west bank. These revisions in span length did not materially affect the economy but the increase in

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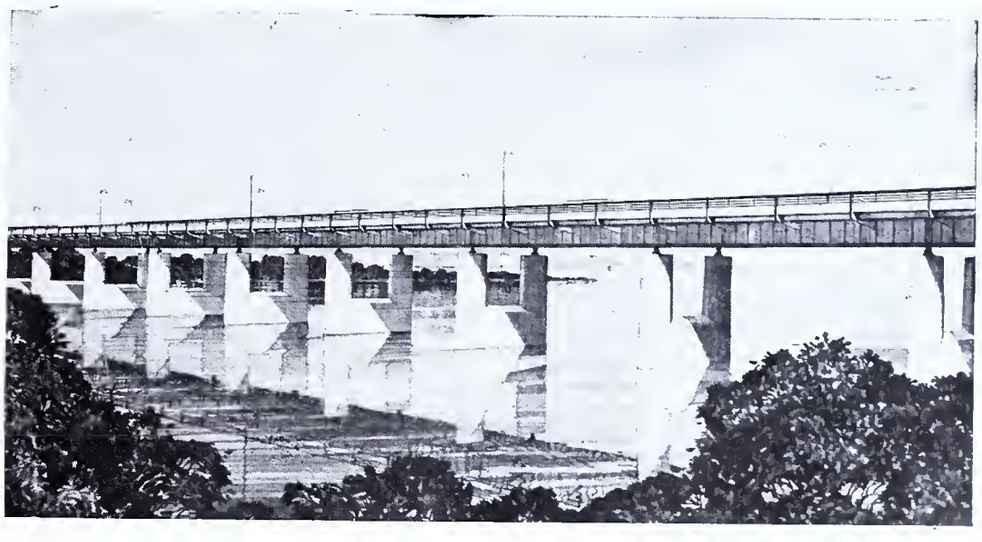


Artist's Sketch of Susquehanna River Bridge.

Political Triumphs or Engineering Triumphs?

Reprint of an Address by Pennsylvania Turnpike Commissioner, E. N. Jones, On Occasion of Western Extension Groundbreaking Ceremony

THIS IS THE third time I have been on hand as a member of the Pennsylvania Turnpike Commission to witness the welding of the same silver shovel officially indicating the start of Turnpike construction work.

It will be eleven years ago next month that this shovel, which you will soon see pushed into the soil of Westmoreland County by the Governor of this Commonwealth, was first put to use. The occasion was the breaking of ground on the first construction contract on the present Turnpike. The location — a remote farm in the Cumberland Valley, east of Carlisle. As I previously recalled the event, I noted that the only audience we had was a farmer, his wife, his two children and his three dogs.

Ten years later, in October of last year, Governor Duff used this same shovel on a hillside overlooking the Harrisburg Airport, and by his act started rolling the machinery that will not stop until the Philadelphia Extension is completed next Fall.

Today we have assembled here to signalize, by the use of this same shovel by Governor Duff, the actual commencement of construction on the extension that will link the western end of the Pennsylvania Turnpike with the highway system of the State of Ohio. We hope that in the not too distant future the concrete and steel structures of the Pennsylvania Turnpike will be joined in matrimony with the concrete and steel of the recently authorized Ohio Turnpike.

I think there is here today only one other person who has been present at all three of these groundbreaking ceremonies. He is Mr. Roger Stone, the Chief Engineer of the Commission.

There is one thought I would like to develop and leave with you in connection with the building of the World's Greatest Highway.

Even now, and certainly when it is completed, the newspapers and magazines, not only of the United States, but of the world will always refer to this completed Turnpike as an "Engineering Triumph".

All great construction projects, dating back even to the Pyramids, are commonly classified as "Engineering Triumphs."

Well — I have a great respect for engineers — I have known many in my time — all kinds. We couldn't build anything without them. They are necessary evils,

just as are bond salesmen, and attorneys who must first put their seal of approval on the bonds before the bond salesmen can sell them.

But the point I want to make and emphasize is that if all these great public enterprises from the Appian Way down to and including the Pennsylvania Turnpike were properly credited they would and should be referred to as the achievements of "politicians".

Caesar, who ordered the building of the Appian Way, was a politician.

Our own great Albert Gallatin, whose home was just over the borderline of this country, the man responsible for the initiation of our first national system of highways in this country — he was a politician.

The great Theodore Roosevelt, whose grandson, now Secretary of Commerce in the Cabinet of Governor Duff, present on this platform today, he without doubt was the greatest politician of his day.

Perhaps the most famous, most useful undertaking of the Nineteenth Century was the Panama Canal. That was the work of the politician Theodore Roosevelt. Many men won fame because of the great work they did in the construction of this great project. It undoubtedly was an engineering triumph but it was a triumph made possible only through the prior achievement of the politician.

The production of the first atomic bomb may not be regarded as a great engineering triumph because everyone considers it to be the victory of the scientists. Yet it was a daring politician who took upon himself the responsibility of taking two billion dollars out of the public treasury to hand over to the generals and scientists as chips in the greatest gamble ever taken by any nation. As it turned out the gamble paid off. The bomb saved hundreds of thousands of American lives, and the two billion dollar plant erected for its manufacture is now producing, in addition to atomic bombs, products that will revolutionize world industry and world medicine.

The man who took that chance, the man who took that two billion dollars out of the treasury on a gamble, the results of which no one could or can foretell — he was a politician — for his friends and enemies all agree that Franklin D. Roosevelt was the greatest politician of his generation.

I bring in his name here because while many men of many varying degrees of stature and ability had long talked about using these abandoned tunnels in the mountains of the Appalachian Barrier as the nucleus of a super-highway across the dividing ridges of the Alleghenies, the Pennsylvania Turnpike could not and may not ever have been built if this same famous politician had not stepped in, after all attempts to market the Turnpike bonds had failed, and ordered the Reconstruction Finance Corporation to buy the unsalcable bonds and then followed up the order with instructions to the Public Works Administration to provide such additional funds as might be necessary to complete the first unit of the Pennsylvania Turnpike System.

Then after the work was completed and after the wise men and the smart men had gone on record with their predictions that the Turnpike would sooner or later become bankrupt, there came on to the horizon of Pennsylvania's public life another politician, a courageous, independent and purposeful man who, after serving with distinction as Attorney General of this state, became a candidate for the office of governor. And this candidate, as we all well remember went up and down and across the breadth of this state telling in blunt language just what he proposed to undertake should he

(Continued on Page 121)

The Proven Worth of The Super Highway

By Charles M. Upham, Consulting Engineer
American Road Builders Association, Washington, D. C.

TRANSPORTATION has long been recognized as one of the important elements in the prosperity and development of a community. The highway program, which pulled the country out of the mud in the twenties also demonstrated its universal usefulness in the development and prosperity of the Nation. Everywhere progress and development has been parallel and proportionate to the means afforded to meet the demands of transportation, especially highway transportation. Practically all commodities in our economy are moved over the highways on some part of the trip from producer to consumer.

As the highway is the controlling factor in our national economy, and as it has been shown time and again that a lack of highway transportation smothers the development of progress, it is evident when traffic demands surge ahead of the provided facilities, the progress in development and prosperity of the community is delayed. The early extensive development of this country was fixed by railroads but the intensive development of the thousands of communities that make up the nation have been brought about through the means of transportation afforded by the highway systems.

Communication and distribution are important factors in prosperity. With no arteries of distribution there will result no business activity. With adequate means of highway transportation facilities, communications and commerce flourish. Business becomes good and our economy is at a high level. Geographic location of industry is no longer the bug-a-boo it was once, because all locations may be reached by highways.

As the demands on our highways begin to reach the capacities of the highways and start to cause congestion and delay, the hindrance to communication and transportation is reflected in the degree of development of industry and commerce. Then, there should be additional highway facilities to provide for the necessary transportation. This can be done in a more economic way by constructing a superhighway that can handle a much larger number of vehicles per unit of investment.

Production and distribution are the basic elements of industry, commerce and agriculture. If either one of these elements is insufficient to meet the demands then the whole economy is affected. If production were increased and there are not sufficient highway facilities to afford economic transportation then our entire national economy is held at a much lower level than it would have been had we adequate highway facilities.

Not many years ago a 2-lane, 18-foot road with suitable shoulders was considered an adequate facility for highway transportation and our economy was evidently limited, to this type of road. As the demands grew greater the highway facilities were improved so that a more adequate highway was constructed to meet the demands of the traffic. Later, in many sections the highway demands became so heavy that more elaborately designed highways were constructed — capable of handling traffic more safely and much speedier, and finally our so called, "Superhighway" was constructed. In this category is included divided highways of four, six or more lanes. It was found that by eliminating cross traffic that an exceedingly high traffic count could be accommodated. The usual inadequacies of our highways to safely serve traffic demands were overcome in the construction of superhighways. Safety records show that proportionately better and a much greater amount of traffic can be efficiently handled on this type of highway.

The death toll on the highway is an index of safety or efficiency. The safety conditions on the highway are influenced both by the highway and the driver of the vehicle. While we cannot completely control the driver the important thing is to remove the hazards and build safety into the highway. It is entirely conceivable that a good driver on an unsafe highway might be in more difficulty than a poor driver on a safe highway.

A few of the outstanding superhighways when compared with the highway system of the State clearly demonstrates that safety can be built into the highway. For the first four months of 1950 the record of fatalities on the Merritt Parkway (a superhighway), in Connecticut, is 3.2 per 100 million vehicle miles, whereas the death rate on the remainder of the

(Continued on Page 146)

"Alright where the traffic is light . . . But, super-highways like the Pennsylvania Turnpike offer efficiency and economy in transportation."

Cooperation Received From Contractors and Others in Building the Philadelphia Extension

By James S. Torrance, Secretary-Treasurer, Pennsylvania Turnpike Commission

THE COMPLETION of the Philadelphia Extension to the Pennsylvania Turnpike will stand as a monument to the many individuals and groups of individuals who combined their efforts in a spirit of utmost cooperation, to form a team that accomplished this victory in the shortest possible time. There were many unforeseen obstacles encountered along the way and such obstacles were overcome through smooth and selfless teamwork by the participants in the project.

T. J. Evans, Chairman of the Commission, with his strong personality, past experience including the construction and administration of the orginial Turnpike, and his ability to foresee and cope with any and all conditions, made him the unquestionable leader of this team.

The Philadelphia Extension was initiated by Honorable James A. Duff, Governor of Pennsylvania, and his wholehearted cooperation, determination, and guidance during the life of the project were a constant source of encouragement that proved to be a vital factor in the ultimate accomplishment.

From the early preliminary stages, through the planning and construction stages to completion, the assistance and cooperation rendered by the Department of Highways under the direction of Ray F. Smock were invaluable and instrumental in the successful completion of the Philadelphia Extension.

Mr. Roger B. Stone, Chief Engineer of the Pennsylvania Turnpike Commission, and his staff were charged with the major task of establishing the line of the Extension, directing the preparation of plans and specifications, and of supervising and inspecting the actual construction. Because of the time limitations, and the size of the project, the obligations imposed upon the Chief Engineer were of unusual proportions and required relentless and untiring effort of the entire staff to attain successful accomplishment.

J. E. Greiner Company, selected by the Commission to serve as Consulting Engineers, was responsible for the preparation of the Engineering Report which formed the basis for financing the Philadelphia Extension; for rendering technical advice and assistance during the financing phases of the project; for supervising and coordinating the preparation of contract plans and specifications; for general supervision of construction; and for per-

forming the duties required of the Consulting Engineers under the terms of the Trust Indenture.

The Commission selected the firm of Parsons, Brinckerhoff, Hogan and McDonald to prepare the Traffic and Earnings Report, which was a companion document to the Engineering Report for financing purposes.

Legal advice and guidance on bond matters were rendered to the Commission by the law firms of Mitchell and Pershing, New York; Reed, Smith, Shaw and McClay, Pittsburgh; and Townsend, Elliott and Munson, Philadelphia. These firms were responsible for the drafting of the Trust Indenture securing the bonds and for all other legal matters precedent to issuing the bonds required for the construction of the Philadelphia Extension and for refunding the bonds which were outstanding on the orginial Turnpike.

Drexel and Company, B. J. Van Ingen and Company, Inc.; The First Boston Corporation; and Blyth and Company, Inc. served as principal underwriters for the new issue of bonds. The services rendered by the underwriting group included the preparation of the bond prospectus, advice on certain sections in the Trust Indenture affecting the marketability of the bonds, a survey of the bond market, the fixing of bond price and coupon rates which were responsible for the successful marketing of $134,000,000 of bonds.

Fidelity-Philadelphia Trust Company, of Philadelphia, has been Trustee for this Commission since its inception. Under the wise leadership of M. S. Altemose, that Institution has been constant in its cooperation, councel and interest.

Final surveys and contract plans for the highway, including grading, drainage, structures, and paving were prepared by Michael Baker, Jr., Inc.; Capitol Engineering Corp.; and Gannett Fleming Corddry and Carpenter, Inc. Modjeski and Masters prepared contract plans and specifications for the Swatara Creek and Yellow Breeches Creek Bridges; and Parsons, Brinckerhoff, Hogan and MacDonald provided the same services for the Susquehanna River Bridge. Plans and specifications for the maintenance buildings, toll booths, and utility buildings were prepared by J. E. Greiner Company.

Upon completion of the preliminary, legal, financing, and planning phases of the project, the completion of the Philadelphia Extension was dependent upon the ability, experience, and skill of the contractors to actually perform the construction operations. The Pennsylvania Turnpike Commission was most fortunate in having the construction work done by a group of contractors representing the best talent available in this part of the country. The Commission was not only fortunate, but was and is grateful for the universal cooperation afforded by the builders of the Philadelphia Extension, who in the face of adverse conditions, (created particularly by poor weather) worked untiringly and bent every effort to complete this highway within the scheduled time.

In setting out the various segments of the team responsible for the successful achievement of the Philadelphia Extension, one would be greatly amiss not to mention the important role played by the general office staff of the Pennsylvania Turnpike Commission. This group was responsible for the acquisition of all right-of-way required for the project, negotiations, and agreements; for all utilities affected by construction; for fiscal control of all funds expended; and for the myriad of other administrative details necessary for the successful completion of a project of this size and scope.

From such a brief review of the many phases and operations which, when in-

(Continued on Page 110)

Our Part In The Philadelphia Extension

By Farley Gannett, President
Gannett Fleming Corddry & Carpenter, Inc.

WE HAVE all heard the Pennsylvania Turnpike ealled the "Dream Highway", but how many have heard that one of the bankers who bought the bonds ealled them the "Glamour Girls of Revenue Bonds."

Anyway, it was a pretty fine dream to start our Pennsylvania Turnpike and when the whole story is told there will be a lot of glamour in it. As we look at it now on the map of the Northeastern States and see its central and conneeting position in the middle of a great thousand-mile, one billion dollar toll highway, from Portland, Maine to Toledo, Ohio — we see what that short 160-mile first pieee of the Pennsylvania Turnpike started. If it hadn't been for it there might be no toll roads today, and if it had not been so well planned, built and operated, its bonds would not be a top grade investment.

We started our work on the Eastern Extension of the Turnpike at the very beginning when Mr. R. B. Stone, Chief Engineer and Mr. John D. Paul, Assistant Chief Engineer were about the only engineers employed on its staff. Nobody knew then just where it was going to run — whether north, through, or south of Laneaster; where it would eross the Susquehanna River, or where it would end, in the vieinity of Philadelphia. Only one thing was known and that was where it would start — at Middlesex, near Carlisle, in Cumberland County.

Working with Mr. Stone and Mr. Paul, and working under their direetion, we laid out on the U. S. G. S. maps three tentative routes — two of whieh were finally eliminated, and at the request of the Turnpike Commission we took bids on an aerial topographic map, whieh job was awarded to the low bidder, the Aero Service eorporation of Philadelphia. On these maps, made to a seale of 200 feet to the ineh, with 5′ eontour intervals, the final loeation of the Eastern Extension was plotted, after frequent field verifieation, to be sure the best loeation was seleeted.

When this loeation was determined, to the satisfaetion of all the engineers and the Turnpike Commission it was formally adopted. We think an exeellent loeation was developed and when you travel over it we feel you will agree with us. Later, we made the detail designs for about 33 miles of this line, from the Susquehanna River, eastwardly.

To me this Pennsylvania Turnpike and those in Maine, New Hampshire, New Jersey and Ohio, whieh have followed it, are business propositions and their building and operation is big business. Governor Duff said last fall that before long the three seetions of the Turnpike, together would be doing a gross business of 20 million dollars a year, and that is not hay! And another thing, these roads ereate work not only during the eonstruetion at the site, but they create a demand for eonstruetion equipment, for eement, reinforeing and struetural steel, and for sand and stone and gravel, for lumber and nails, and for a thousand other materials, to say nothing of engineers, aeeountants, surveyors, and operating men. When the Philadelphia Extension is finished a eonsiderable foree of permanent employees will be required to operate it. Of course I need not refer to the employment of consulting and designing engineering firms, of which ours was one, which helped at the very beginning to lay out the line, and later to design the details of the road and bridges, for the eastern and western extensions.

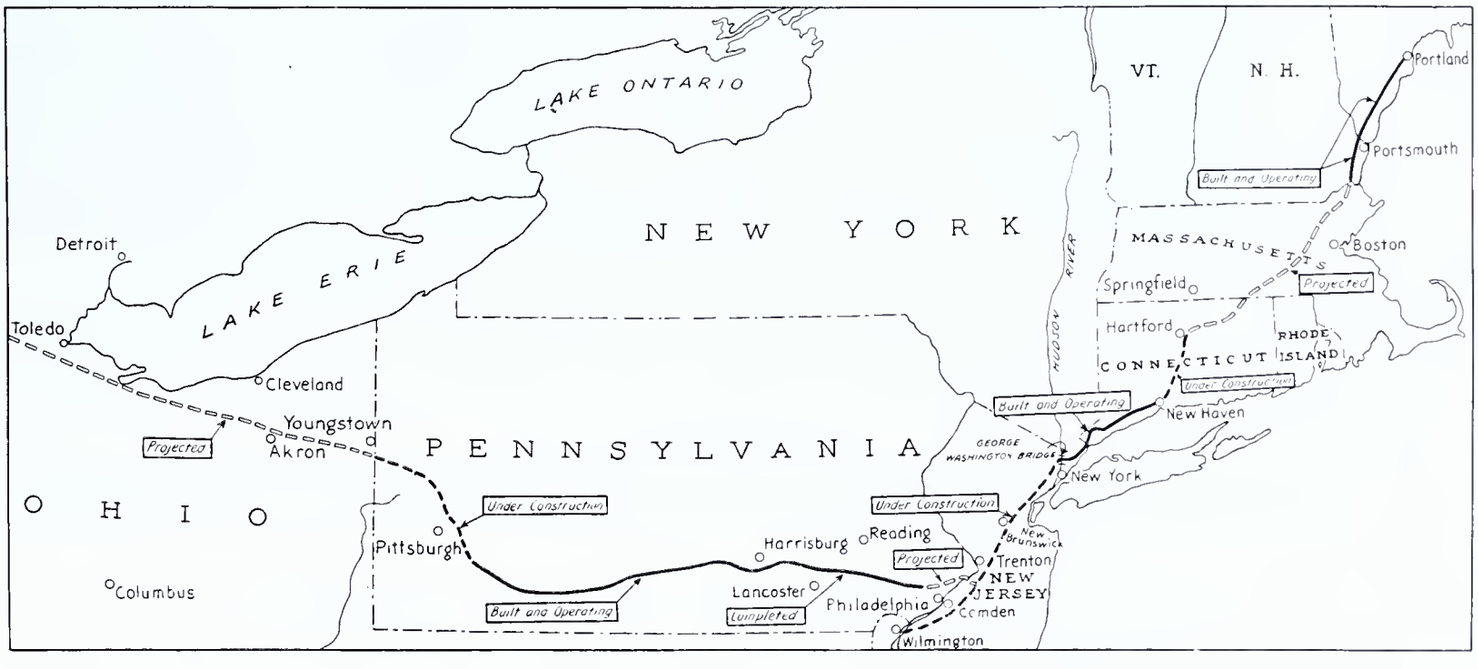
These Turnpike bonds are venture eapital and cheap 2% and 3% venture capital. Of eourse any eapital raised to execute a new job is venture eapital, thus a part of the many water authority bond issues and all of most sewer authority bond issues are venture eapital. It is venture eapital whieh we need to make our eountry progress.

If the Western Extension is opened in 1951, as expeeted, it will be just four years from the time the two extensions were started and by that I mean planning for them. Thus, this 167 miles will take only four years from start to finish.

The Federal Government and perhaps some States, are not enthusiastie over toll roads. Pennsylvania is, however. There are various reasons why some are against them but there are many reasons why others are for toll roads. Of course the best reason is that they ean be built without raising or ereating new taxes. He who uses it pays for it.

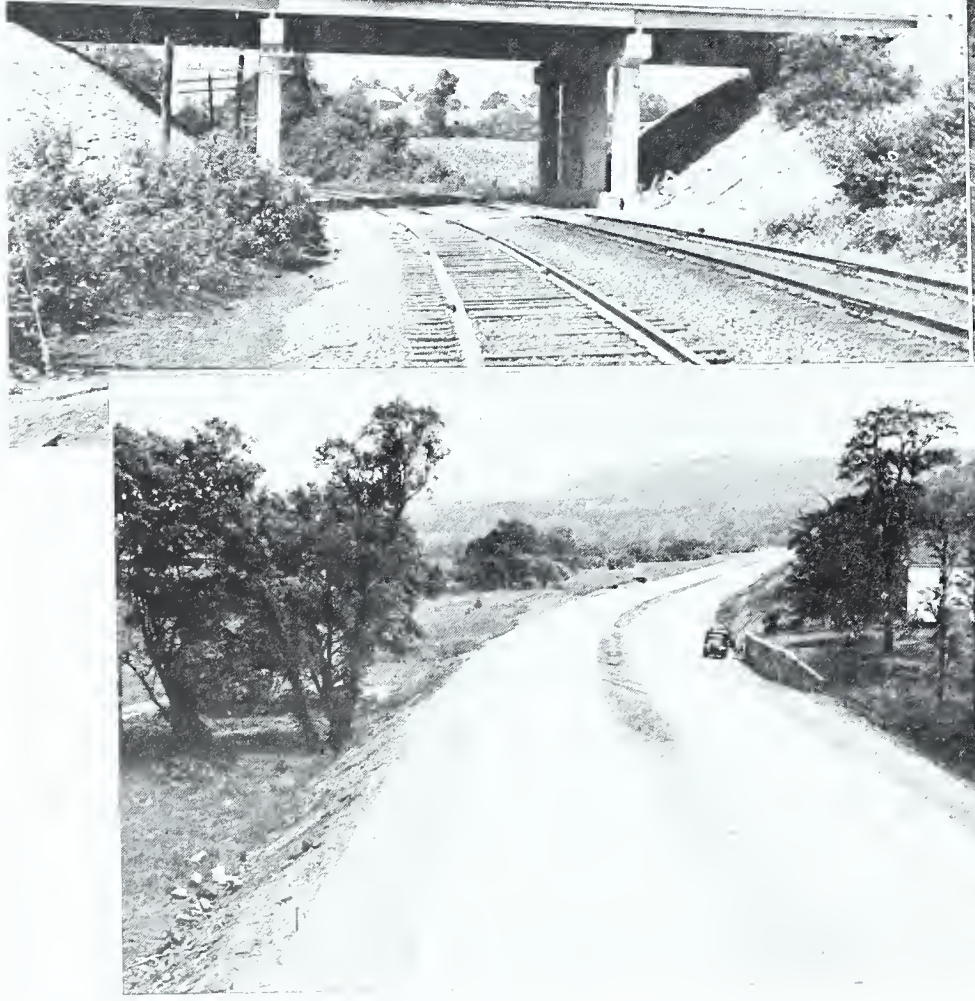
There is one point that is very seldom mentioned about the benefit of toll roads sueh as ours, and that is this. Our Turnpike earries a great many trueks and buses and in so doing takes these off the other free roads. Thus in turn it eliminates the

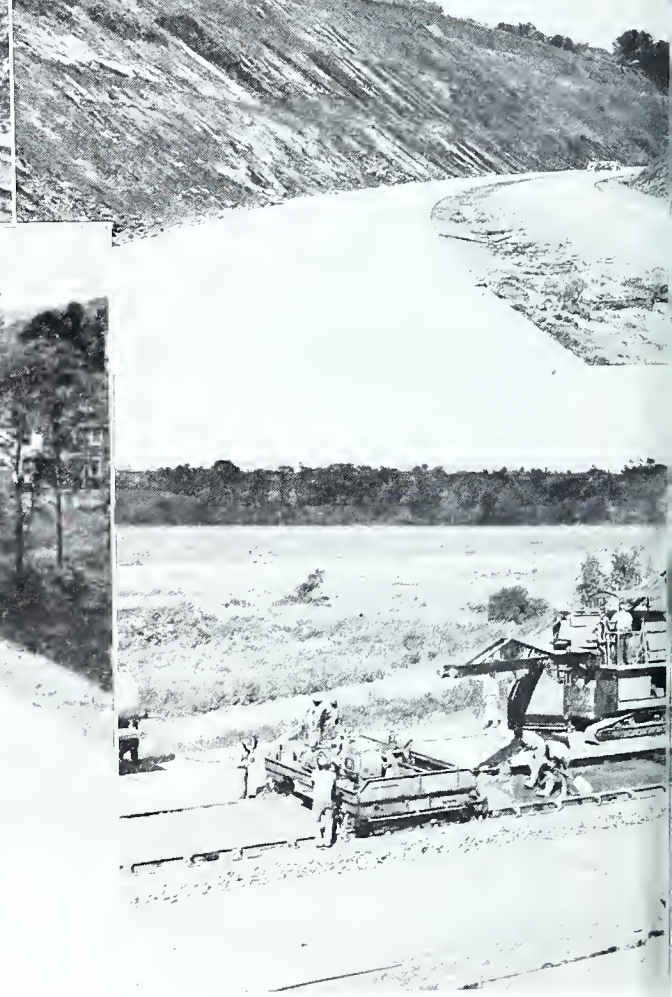
(Continued on Page 142)



Map showing completed Turnpikes and those under construction and those proposed from Portland, Maine to Toledo, Ohio.

Signs of the times →→→→→

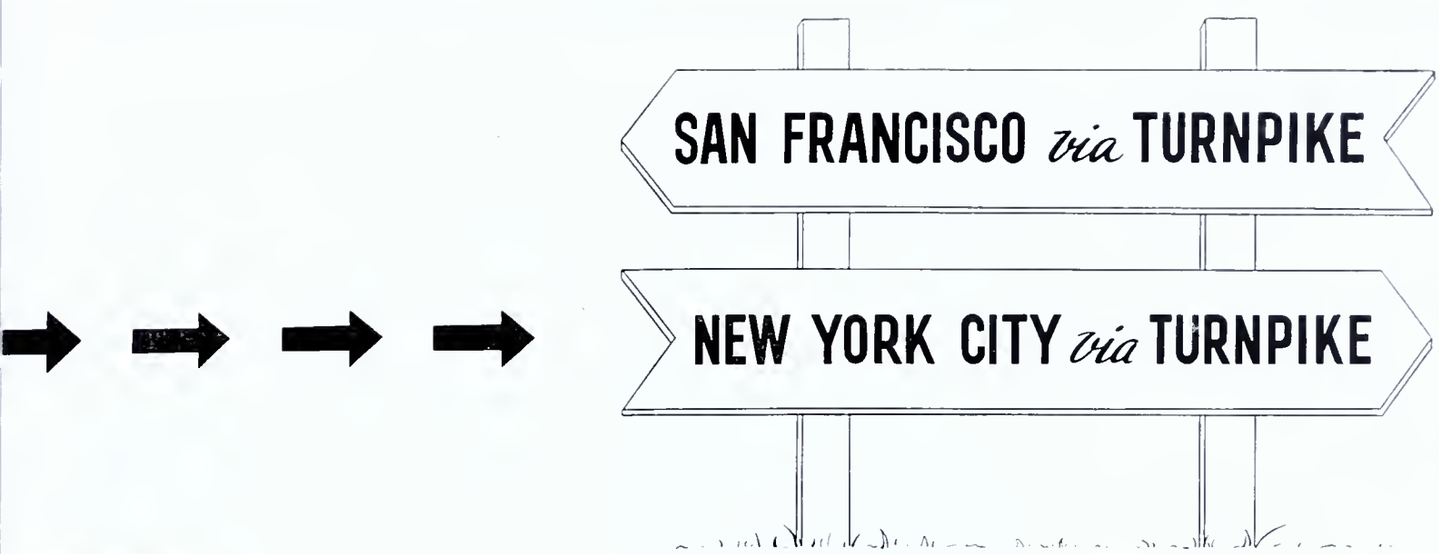




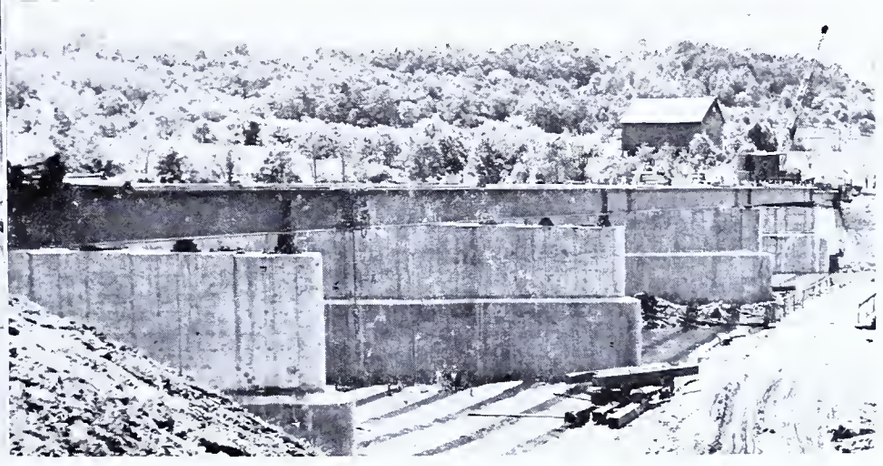
General Contractor . . .

CENTRAL PENNSYLVANIA QUARRY, S

Bridge Contractor: REED & KUHN



Some day we may have a coast to coast high speed turnpike. We are proud that our state has taken the initiative and by the end of 1951 will have such a turnpike in operation from the Ohio State Line to the New Jersey State Line. We wish to compliment those responsible for their vision and foresight and the Pennsylvania Turnpike Commission for the conversion of these dreams into a reality. We are proud of our contribution in the construction of several sections of this super highway, realizing the great convenience, safety and time saving this thoroughfare will mean to millions of motorists and truckers.



Contract 201—Sec. 22-C in York County

Contract 222—Secs. 21B-2 and 22A-1 in Cumberland and York Counties.

RIPPING & CONSTRUCTION COMPANY

Paving Contractor: WILLIAMS PAVING CO., INC.

Performance of Original Section Sets Type on Turnpike Projects

Twin Ribbons of Concrete Soon to Span Pennsylvania As Philadelphia Extension is Dedicated; Work Pushed on Link to Ohio

By George C. Britton, District Manager of Portland Cement Association

THE WORLD'S greatest expressway—twin ribbons of concrete — soon will tie together two of the most important areas in America.

At present two links of this highway are completed; the remaining section will be in use within a very few months.

Ultimate benefits to be derived from any highway development program are well known to all of us. It is not within the province of this brief item to enumerate the economic, social and political advantages a people enjoys when travel is rapid, safe and easy — when all are neighbors in a large community.

One decade ago the original 160-mile section of the Pennsylvania Turnpike System was opened to the public. This afforded an easy crossing of the mountain barrier that separated East and West for so many years. The effect on East-West traffic was immediate. The great industrial Pittsburgh area moved hours closer to the East.

Now a second, 100-mile link in this modern system is being opened to the public use, joining the important Eastern shipping and receiving centers with the original Turnpike. Within a very short time the third link in the System will be completed to join the original section and provide a modern, controlled-access, high speed expressway from the Ohio border to Philadelphia 327 miles away.

Regardless of the success of the mountain section of the Turnpike it took boldness of thought and keen foresight to initiate the two extensions.

By means of 22 "enroute" interchanges the Turnpike System will serve practically every community and industry in the Commonwealth. It will bring Pennsylvania's famed resort areas closer to millions. It will provide a look at practically every type of scenic beauty for which this State is well known everywhere. It will provide the utmost in motoring speed, comfort and safety not only for motorists seeking destinations all along its route but also for heavy duty transportation, both commerical and military.

The mere fact that another road has been built is of little or no consequence. There have been roads since the earliest days. But this road typifies what can be accomplished when the skills of the planner, engineer and constructor are joined to provide the best possible highway not only for present traffic requirements but also for requirements expected to develop in the next two score years or longer. The Pennsylvania Turnpike System, then, is an example of modern, major highway construction embodying all the qualities of a limited-access arterial throughway planned to serve a progressively growing service demand throughout its life.

Still, the difference between building a Turnpike System and any other modern highway is merely one of magnitude of the project. The unusual size of the Turnpike extensions permits consistent application of the highest standards of design over long mileage. In either the Turnpike or any other highway project the same basic factors obtain. The highway's need is determined, traffic weights and volumes are projected into the future, and a pavement design is selected to give the lowest vehicle-mile cost over the anticipated life of the road. Engineers, then, design the whole structure — and a highway is an engineering structure — to provide the facility desired.

Stated differently, engineers designing a Turnpike or any other road must take into consideration the earning capacity of the structure they plan. Obviously this

(Continued on Page 139)

View of Pennsylvania Turnpike showing a portion of the "two ribbons" of concrete that will soon span the State.

The Special Design Problems of The Turnpike

By Michael Baker, Jr., President
Michael Baker, Jr., Consulting Engineers, Rochester, Penna.

EARLY IN 1948, Honorable James H. Duff, Governor of the Commonwealth of Pennsylvania and Honorable Thomas J. Evans, Chairman, of the Pennsylvania Turnpike Commission announced to the people of the Commonwealth that the present 163 mile Pennsylvania Turnpike would be extended both to the Ohio-Pennsylvania line and to Philadelphia and that the construction of these extensions would be under way before the expiration of the Governor's term of office in 1950. This promise of immediate construction was passed on to the engineering organizations who were commissioned to do the work and thus became the major factor in the design of these extensions.

In May of 1948, Michael Baker, Jr., Inc. was given the first of a total of seven contracts for the design of construction of the eastern extension of the Turnpike, and field survey corps were immediately assigned to the work.

In the ten years following the completion of the original portion of the Turnpike in 1940, the Commission considered alternate locations for the extension towards Philadelphia and a definite line was adopted by the Commission. This alignment, based on the Pennsylvania Plane Coordinate System, was established and deviation from this line, as indicated on the photogrammetric prints, was not permitted except as ordered by the Commission.

The gradient for the Turnpike extension was determined by the Commission from photogrammetric contour plans and revision was permitted to fit special conditions at grade separations and to balance earthwork where possible. Results of soils investigations, which were furnished our engineers as planning progressed, were the basis for computing earthwork shrinkage or swell, and for establishing foundation elevations for structures.

Our field engineers, having a specific alignment, met with the owners of the land over which the Turnpike was to run, and by patient explanations and careful consideration for the owners' crops and the owners' other rights, were able to expedite the acquisition of the field information necessary for the construction plans.

Since approval of the Turnpike Commission, the Pennsylvania Department of Highways, and the local township supervisors was required before final surveys were made, preliminary plans for submission were prepared from the photogrammetric drawings. In some instances, however, it was necessary to supplement the aerial survey data with field surveys to obtain information which would enable us to plot alternate locations, alternate gradients, and other variations from the basic planning alignment which we thought to be in the interest of the Commission. Sometimes we would predict approval and make our field surveys before official approval was received and, if required, make paper changes by relating the desired construction center line to the center line established on the ground.

Design of grade separation bridges was started as early as possible since our sections called for 31 such separations from other roads and two from railroads. The architectural features adopted for the original Turnpike were used throughout the eastern extension. Considerable thought was given to using the plans of similar bridges from the original Turnpike where they were applicable, but this was found impossible and complete design and detailing of all new bridges was necessary.

A grade separation which would span the existing intersection of U. S. Routes 23 and alternate 23 west of King of Prussia created the problem of obtaining adequate sight distance through all quadrants. This daylighting of the intersection was accomplished by the use of a continuous steel beam bridge and a modification of the standard slopes.

The location of the Turnpike at King of Prussia and the expressway to Philadelphia was the subject of an engineering report made by our firm for the Pennsylvania Department of Highways. In this report the interchange ramps were studied in relation to the needs of not only the Turnpike and the Philadelphia Access Highway but to accommodate the anticipated turning movements with the present highways as well.

Originally the location of the toll plaza was to be within this area but after the necessary ramp locations were determined, another location seven miles west of King of Prussia was selected. This new location was predicated on the need for adequate space for traffic merging at the entrance and for deceleration of traffic upon leaving the Turnpike. The latter precaution was deemed advisable because of the so-called "driver's fatigue" which

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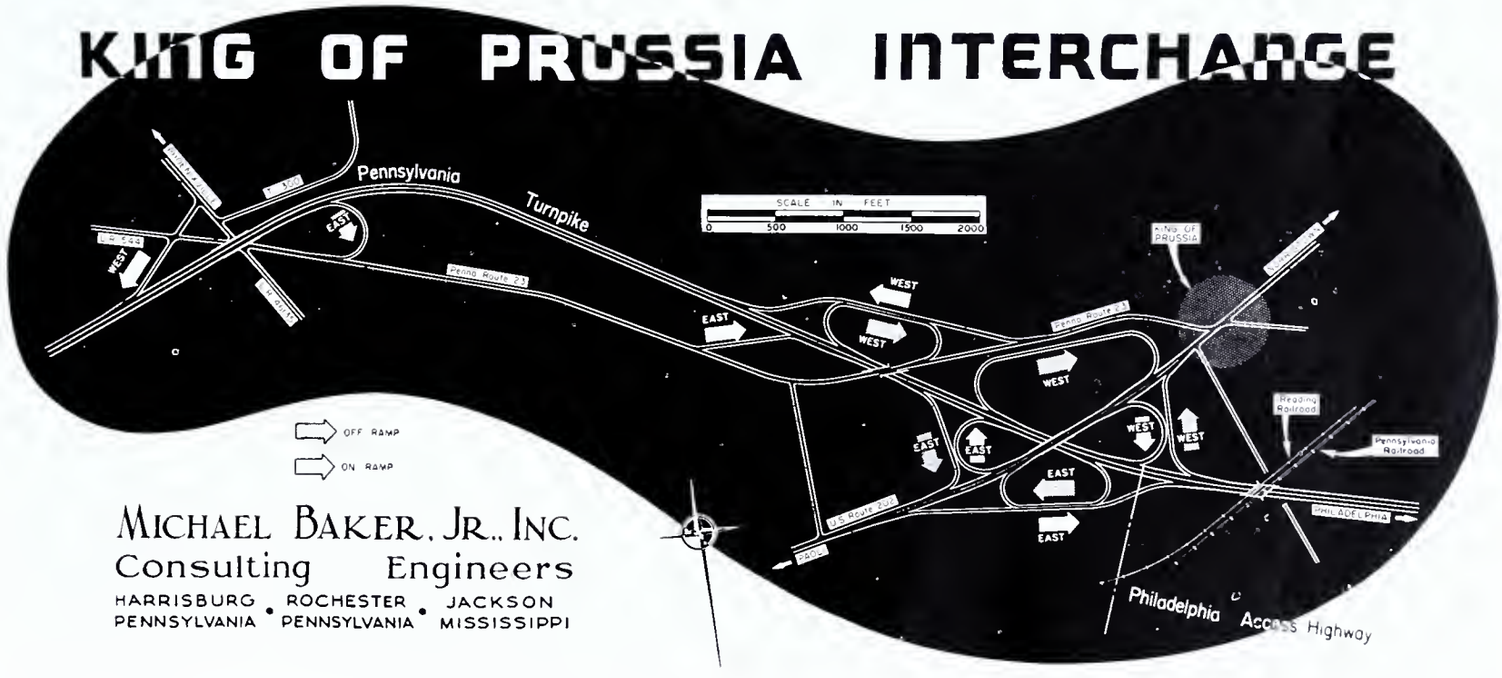


"The Progress Statistics --- Penna. Turnpike"

By -- Paul J. McNeill, Chief Statistican
Pennsylvania Turnpike Commission

ACROSS the dark backdrop of strife, confusion and general destructiveness, men and women of a peaceful land are busy carving a dramatic story of American ingenuity, and progress out of the rock and soil extending across the State of Pennsylvania. They are building extensions to the existing Pennsylvania Turnpike; The Philadelphia Extension, which is substantially completed at this time and the Western Extension, which is entirely under contract and on which construction is progressing satisfactorily. These men have been planning, digging and building since early summer 1948, translating into somcthing definite and tangible the recognized needs of modern travel.

Represented in the project is the work of planners who have translated knowledge of the public's needs into action; the efforts of engineers havc created all necessary designs; the new equipment, new technique contributions of manufacturers working in close cooperation with Contractors: and the efficient accomplishments of Contractors themselves who have brought out of the abstract a visible, usable ribbon of broad concrete highway that will endure well into the future.

The Pennsylvania Turnpike was authorized by an Act of Assembly of our Legislature in the year 1937, which Act created the Pennsylvania Turnpike Commission and directed them to finance, construct, operate and maintain the Pennsylvania Turnpike from a point near Irwin, Westmoreland County, approximately twenty (20) miles East of the city of Pittsburgh to a point at or near Middlesex, Cumberland County about sixteen (16) miles West of Harrisburg.

Construction on this original project was started the latter part of October, 1938, after financial arrangements had been completed on October 10, 1938. The original project was one hundred and sixty (160) miles long including seven (7) tunnels, aggregating a length of 6.7 miles. It was constructed with a maximum grade of three (3%) per cent and maximum curvature of six (6) degress. The finished roadway was constructed with a width of seventy-eight (78′) feet, made up of two (2) twelve (12′) foot lanes for each of eastbound and westbound traffic with opposing traffic, separated by a ten (10′) foot medial strip and with a ten (10′) foot shoulder on each side. The entire construction was completed within twenty-three (23) calendar months, and the

Turnpike was opened to traffic on the first of October, 1940. It is now in the tenth year of operation and the success of the project is now a matter of record, and it is apparent that many other States are following the example of the Pennsylvania Turnpike in this field of endcavor.

The special session of the Legislature in the year 1940, by an Act of Assembly provided for the extension of the Turnpike from its Eastern Terminus at Middlesex to a point at the City of Philadelphia, said extension to be known as the Philadelphia Extension.

On April 12, 1948, the Pennsylvania Turnpike Commission adopted the alignment for the Philadelphia Extension and authorized immediate construction of the Philadelphia Extension from Middlesex to King of Prussia. The financing of the Philadelphia Extension together with the refinancing of the operating Turnpike was arranged in June, 1948, with a sale of a bond issue of $134,000,000.00 representing $47,000,000.00 for the redemption of and refinancing of the indebtedness on the existing Turnpike and $87,000,000.00 for the construction of the Philadelphia Extension. Actual construction thereon, was started on the 28th day of September, 1948, at the ground breaking ceremonies held in York County.

Immediately following the ground breaking in September, 1948, contracts were awarded as rapidly as plans could be completed. Several of the original contracts were awarded for grading, drainage and structures only. On these, paving was added by Change Orders, and all subsequent contracts were awarded to include grading, drainage, structures and paving. The last contract was awarded on August 31, 1949, at which time there had been awarded a total slightly in excess of $58,000,000.00 Construction work involved about $39,500,000.00 in grading and drainage and $18,500,000.00 in paving. The progress of the work developed at a very rapid pace.

The entire grading, drainage, structures and paving on the Eastern Extension was divided into twenty-eight (28) contract sections. In this 101 miles of roadway, there are twenty-two (22) contracts on which work is being performed by seventeen (17) different general contractors, having one or more subcontractors performing a portion of the work. As of the 1st of August, 1950, better than 92% of all the grading, drainage and structure work for the 101 miles was completed and better than 60% of all the paving work was completed. The Susquehanna River Bridge as of this date was substantially completed.

In order to more readily grasp the magnitude of a project of this nature, it is felt that a portion of the quantities making up a few items of the construction contracts should be mentioned, such as: 15,122,648 cu. yd. Class 1 Excavation, 545,149 cu. yd Class 2 Excavation, 550,361 cu yd. of Borrow Excavation, 4,868,067 sq. yd. Special Subgrade, Turnpike 6″ deep, 581,722 l.f. Turnpike Stabilized Shoulders, 2,977,583 sq. yd. 9″ reinforced concrete paving, 24′ width, 57,116 cu. yd. Class A Concrete, 137,552 cu. yd. Class B Concrete, 18,823,367 lbs Plain Steel Bars, 19,401,698 lbs Fabricated Structural Steel, 378,981 l.f. 6″ Tile Underdrain.

The construction on the Philadelphia Extension is to all intents and purposes similar to the construction of the existing Turnpike. The differences between the two projects are as follows: (1) The Philadelphia Extension does not include any tunnels, although it does include three (3) major bridge structures, namely, Susquehanna River Bridge, Swatara Creek and the Yellow Breeches. (2) The maximum grade is 2% contrasted to the maximum of 3% grades on the existing Turnpike. (3) Maximum curvature is 4° as contrasted to a maximum of 6° curves on the existing Turnpike. (4) Continuous drainage in the Medial Strip and also placement of 6″ special subgrade underneath the 9″ reinforced concrete paving.

The construction for the Philadelphia Extension is progressing satisfactorily and

(Continued on Page 120)

"History Repeats"

By H. A. Windisch, Executive-Secretary
The Contractors Association of Philadelphia

SINCE MAN first invented the wheel he has been engaged in finding ways and means to provide transportation over surfaces on which the wheel could travel with comfort and speed.

In going back through history we find that China had developed a system of highways as early as 2700 B.C. During the Chow Dynasty beginning in 1122 B.C. an effective system of roads was laid out, classified, improved and an organization established for the administration of the road system. The first Post roads in China were laid out between 617 and 960 A.D. During the 15th Century the Ming Dynasty surfaced the main highways with stone slabs laid in mortar. On the other side of the world as early as 2000 B.C. historians write of the excellent roads, radiating from Babylon to Susa, Ecbatana, Sardis and Nineveh. One historian by the name of Itrabo, about 2700 A.D., mentioned the roads between Babylon and Nineveh as being paved with brick, laid in mortor of asphaltum.

Even in South America history records the "Road of the Incas", built around 900 A.D., extending from Quito in Equador along the western slope of the Andes for approximately 3000 miles, terminating in Central Chile. The road was stone surfaced.

The Roman Empire established a system of military roads, many of which are today the foundations of existing highways. After the fall of the Roman Empire around 400 A.D., history records a decided lack of interest in the construction of international roads. Each country was concerned about the maintenance and construction of highways within the borders of that country, but no attempt was made to develop a system of highways which would permit of travel between different countries. This condition existed for approximately 1500 years.

The large scale introduction of toll roads began in England in approximately 1665. During the years that followed 1700, companies were chartered to construct highways and collect tolls for the use thereof. The origin of the word "Turnpike" dates back to this era. Most every one has heard of the long pike used by foot soldiers as a weapon during this period in English History. A simple toll-gate was constructed by mounting two pikes at right angles on a post with a pivot through the cross to permit of turning the devise. This obstruction was placed in the center of the road way and after the traveller had paid his toll he

was permitted to continue on his journey by passing through the revolving pikes. Consequently, the origin of the word "Turnpike".

The first standardized types of road construction were attempted by Messrs. Thomas Telford and John L. McAdam who wrote the specifications for the first stone surfaced roads. Basically they are still used for flexible type pavements. These two gentlemen lived in England and Scotland in the early part of the 19th Century.

While Wm. Penn laid out the City of Philadelphia in squares with the streets in a North and South and East and West direction, there are several old highways which today are part of the street system and incidentally, cause some of the confusion in travelling through Philadelphia today. There were originally nine of these highways, which radiated from the early settlement of Philadelphia. North and South highways which connected the areas of New York, Trenton, Philadelphia and Baltimore, were possibly the first heavily travelled roads on the Eastern seaboard. These were the Baltimore Pike, the Chester Pike and the Bristol Pike.

After Wm. Penn had made original purchase from the Indians, the real colonization of the Eastern part of Pennsylvania began. This period saw the development of the Ridge Pike, the Germantown Pike and the last and most important, the first colonization along the Philadelphia - Lancaster highway.

Early settlers West of Philadelphia were Welsh, which is the reason for so many of the localities adjacent to Philadelphia having names of Welsh origin, such as Merion, Narberth, Bryn Mawr, Llanerch and countless others in this vicinity. Prior to the Welsh, the first settlers to attempt establishing of homestead in the fertile lands West of Philadelphia were the Swedes. The first known route to be travelled was known as the Kitanning Path, an Indian Trail. It was one of the earliest trade routes of this section of Pennsylvania. The Kitanning Path began on the West side of the Schuylkill in the vicinity of the junction with the Delaware River.

As early as 1710 travellers saw the advantage of locating mills along the Brandywine Creek in what is now known as Downingtown. The first name of this community was Mill Town. After the Downing family had established the first grist mills in this area, the name was changed to Downing's Mill. Later there were two sections to the Village, Downingtown and East Downingtown. The Village became a stopping point for all travellers, including the Dutch immigrants who later settled along the Conestoga Creek, at the boundary of what today is the City of Lancaster. Philadelphia, Downingtown and Lancaster were the three control points in the laying out of the original Conestoga Road or as it was otherwise called the Old Philadelphia Road.

The first attempt at clearing a highway along the line of the Old Kitanning Path was between the years 1733 and 1741.

Prior to, and during the Revolution, with the development of Lancaster as the head of the Wagon Train Routes towards the West, traffic on the old Conestoga

(Continued on Page 112)

The Cover

Artists conception of the Harrisburg-West Shore Interchange, on relocated U. S. Route 111, which leads toward York at the Upper Right of the illustration. The Turnpike Bridge across the Susquehanna River is Beyond the horizon at the upper left.

The Interchange was designed by Capitol Engineering Corporation, Dillsburg, Pennsylvania.

Radio Communication Primary Safety Factor on Pennsylvania Turnpike

By Louis P. Clark, Vice President
Raymond Rosen Engineering Products, Inc.

THE OPENING of the Pennsylvania Turnpike in 1940 gave the motoring public a revolutionary highway which established new standards of convenience, safety, and economy.

The success of the far sighted planning responsible for the original turnpike is best illustrated by the decision to extend this super-highway to its new length of 327 miles.

In order to care for every requirement of the motorist, this same far sighted planning went far beyond the design of a physical road and incorporated many added features to provide complete protection, service, and traffic control. Among these was a complete radio communication system.

As plans for the Turnpike developed it became apparent that a means must be established for immediate contact between the Turnpike office, police headquarters, maintenance headquarters, tunnel portal buildings, maintenance buildings, interchanges, patrol vehicles, and emergency trucks. Because of the absence of wire line facilities and because of the mobile application involved, the only medium capable of accomplishing this complete communication service was radio.

The requirements for a radio system to provide optimum results made it necessary that all communications be heard simultaneously at fixed locations and in all mobile units. The very nature of the Turnpike, stretching across 161 miles of mountainous terrain, made this a difficult problem. However, the topography which introduced obstacles to complete radio coverage also held the solution to this difficulty.

Extensive engineering studies and field surveys were made by Raymond Rosen and Company to determine the type of system which would produce the desired results, yet be economically and operationally sound. Earlier experience gained in the design and installation of a radio network for the Pennsylvania Department of Forests and Waters for flood reporting was put to excellent use. Here the first unattended multiple radio relay system ever installed had proven highly satisfactory. Application of the same principles to the Turnpike system offered the logical approach since similar conditions prevailed.

Accordingly, a system was designed using the mountain tops above the Turnpike right of way as radio station sites, thus putting to advantageous use the mountains which created the original problem.

Basically, the system designed and installed by Raymond Rosen and Company consisted of 116—119 mc relay stations located on mountain tops with associated 30—40 mc stations at certain of these sites, plus 30—40 mc two-way units at the fixed stations previously outlined and 30—40 mc two-way units in mobile, patrol, and service vehicles. All mountain top stations were unattended and control of the system was accomplished from any of the fixed or mobile units.

In order to illustrate the operation of the system, assume that the Harrisburg office of the Turnpike Commission wished to contact a patrol vehicle on the Turnpike. The transmission from Harris-

(*Continued on Page 142*)

Engineering Problems of the Turnpike

By John D. Paul, Assistant Chief Engineer
Pennsylvania Turnpike Commission

WHEN THE decision was made by the Turnpike Commission to develop the Philadelphia Extension and the Western Extension it posed a complex engineering problem of considerable magnitude peculiar to a Turnpike.

In the solution of that problem the engineering policy included the determination to provide within practical limits every improvement in the field of highway design which would contribute to the safety and confort of the turnpike user, and result in the longest service life at the lowest maintenance cost. The policy also included a maxim which was founded during the engineering development of the operating portion of the Turnpike to "keep ahead of the automobile."

Considerable value is attached to the item of "Time" in every engineering phase of our work, and there is a constant war in progress to conserve and use it to the best possible advantage. Since the function of other departments of the Commission are geared to and with the engineering department, the war against "Time" is general and continuous.

In appearance, the Turnpike extensions will not vary greatly from the existing facility which has served the motoring public and its investors so well during the ten years of its service life. This is not accidental. However, there are certain features about the extensions which are comparatively new and compatible with portions of the general engineering policies mentioned but yet might not be recognized as such by the casual observer.

The selection of a route required a study of the character of the geography and geology of the general portions of the State to be traversed by the Extensions. In some areas available maps were not of recent development and quite often of dubious value except for very preliminary study. Others had been revised but all were, at best, but a guide to route selection. A decision to utilize modern aerial mapping techniques for the specific route selection proved to be timely and advantageous. From aerial photographs contour maps were produced, including practically all topographic objects. Photographs were analyzed stereoscopically and all maps were carefully studied, related to geologic maps and reports, which resulted in the final route selection. This general technique was first investigated during the engineering development of the Turnpike ten years ago but found to be impossible of attainment. Consequently, much time and effort was unavoidably spent at that time in field mapping critical areas for which maps were non-existent.

Due to the possibilities afforded by location, the maximum gradient of the Philadelphia Extension is but two per cent and the maximum curvature three degrees. For the Western Extension the maximum gradient is three per cent and the maximum curvature is four degrees. Our standards of spiral curvature and superelevation have been maintained throughout.

In addition to the geologic studies which customarily form a part of our work, it was decided to initiate geophysical investigations by an electric resistivity method, coordinated through our geologic section to determine not only what kind of rock was to be encountered but approximately how far below the ground surface it might be anticipated. As an additional feature, the depth of ground water was also determined from the same data. The information was of considerable value to the engineers and the designers. Since it was available to contractor-bidders at their option, we believe it may have had a favorable effect in the bid prices obtained.

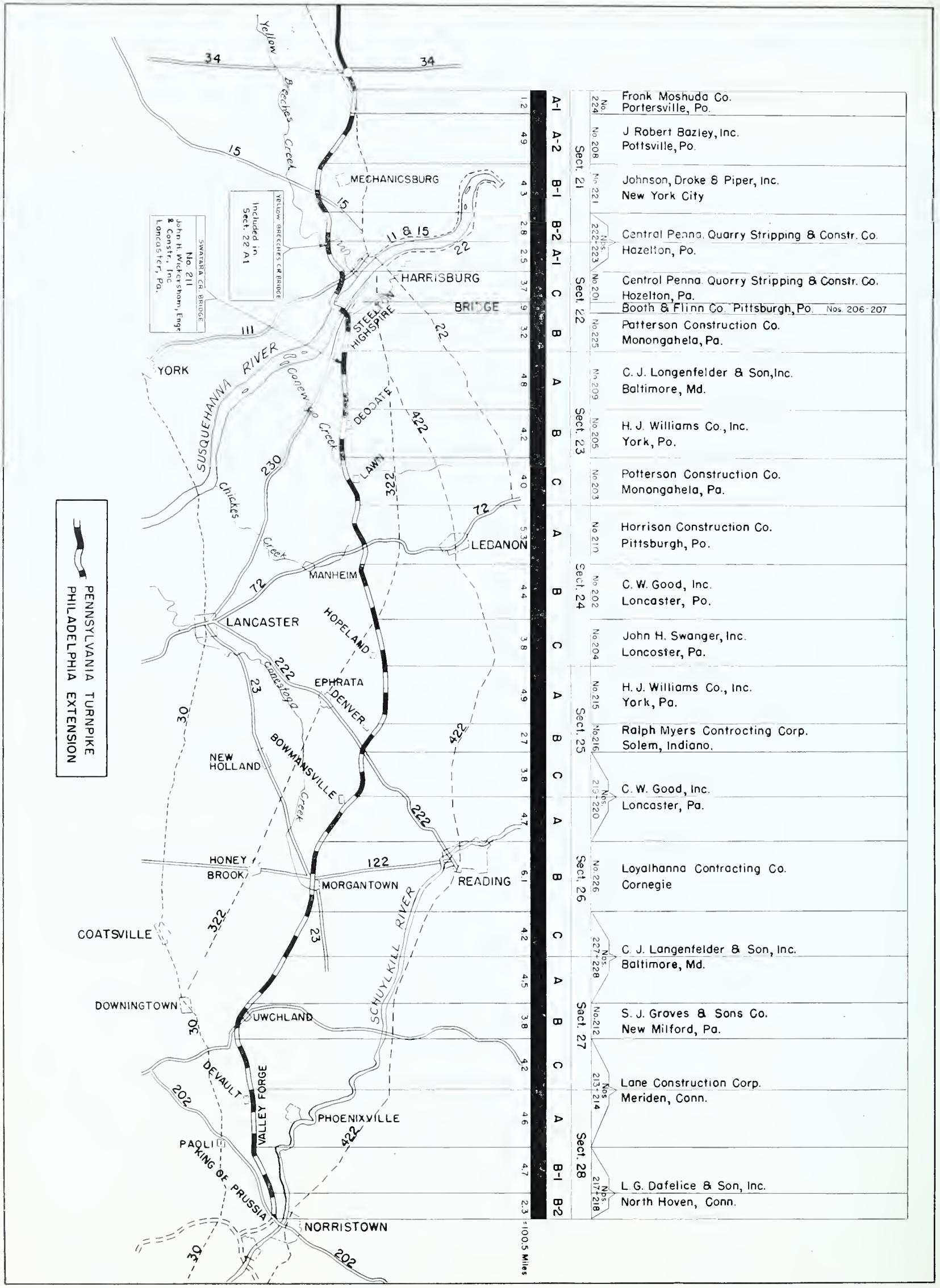
In connection with our studies applicable to pavement design, and based on conditions revealed by our preliminary investigations, it was determined to provide a drainable subgrade material which would add to subgrade bearing value and combat the nationally known phenomena of "pumping". To meet these requirements, supplies of local materials were investigated throughout the area to be traversed and several types were found acceptable within necessary limitations. To assure the desired features Specifications were prepared for four gradations ranging from coarse to fine. To assure continuous transverse drainability the material was designed to be placed across the entire roadbed section from shoulder edge to shoulder edge throughout. Longitudinal intercepting drainage structurers were designed for placement at the outer edge of shoulder lines in cuts and throughout on centerline. This special subgrade item became quite interesting to the contractors on our early contracts and subsequently many new sources of material were located by other contractors, some of whom devised unique methods of obtaining and preparing such materials for use. For example, it proved economical for several contractors to install processing plants where materials on or near the job were of proper quality for this item of work. Contractors were encouraged to place this material as early as possible after grading work had been completed in order to expedite the paving operation. Less time was lost due to wet grade than had previously been experienced, consequently the turn-around on cement cars was accomplished much more rapidly. This, in turn, aided the cement industry in arranging shipments with the limited number of cement cars available for use.

An additional development has been provided for each ten-foot wide shoulder area. A stabilized material was designed which would retain its position under normal traffic usage. Whereas the special subgrade material was designed to be porous, the stabilized shoulder material was designed to be dense and cohesive composed of a mixture of graded coarse aggregate and clay. Data leading up to the design of this feature evolved from our studies of local materials. Again our contractors were able to locate many new and satisfactory sources of supply thus speeding the construction progress.

The design of the reinforced cement concrete pavement proper provides for a minimum expansion joint spacing of 900 feet, contraction joints are spaced at intervals of 46′6″. In addition, air-entraining cement is specified for the concrete mixture.

Bridge structures were designed in ac-

(Continued on Page 134)



Sect. 21	No. 224	Fronk Moshuda Co. Portersville, Pa.
	No. 208	J Robert Bazley, Inc. Pottsville, Pa.
	No. 221	Johnson, Droke & Piper, Inc. New York City
	Nos. 222-223	Central Penna. Quarry Stripping & Constr. Co. Hazelton, Pa.
Sect. 22	No. 201	Central Penna. Quarry Stripping & Constr. Co. Hazelton, Pa.
		Booth & Flinn Co. Pittsburgh, Pa. Nos. 206-207
	No. 225	Patterson Construction Co. Monongahela, Pa.
Sect. 23	No. 209	C. J. Longenfelder & Son, Inc. Baltimore, Md.
	No. 205	H. J. Williams Co., Inc. York, Pa.
	No. 203	Potterson Construction Co. Monongahela, Pa.
Sect. 24	No. 210	Horrison Construction Co. Pittsburgh, Pa.
	No. 202	C. W. Good, Inc. Loncaster, Pa.
	No. 204	John H. Swanger, Inc. Loncaster, Pa.
Sect. 25	No. 215	H. J. Williams Co., Inc. York, Pa.
	No. 216	Ralph Myers Contracting Corp. Solem, Indiana.
	Nos. 219-220	C. W. Good, Inc. Loncaster, Pa.
Sect. 26	No. 226	Loyalhanna Contracting Co. Cornegie
	Nos. 227-228	C. J. Langenfelder & Son, Inc. Baltimore, Md.
Sect. 27	No. 212	S. J. Groves & Sons Co. New Milford, Pa.
	Nos. 213-214	Lane Construction Corp. Meriden, Conn.
Sect. 28	Nos. 217-218	L. G. Dafelice & Son, Inc. North Hoven, Conn.

Builders of Philadelphia Extension--Pennsylvania Turnpike System

CONTRACT NO.	SECTION	GENERAL CONTRACTOR	SUB CONTRACTOR	ADDRESS
201	22-C	Central Penna. Quarry Stripping & Const. Co.		Hazleton, Pa.
			Reed & Kuhn	Elysburg, Pa.
			Williams Paving Co., Inc.	Norfolk, Virginia
202	24-B	C. W. Good, Inc.		Lancaster, Pa.
			J. Richard Nissley	Landisville, Pa.
203	23-C	Patterson Construction Co.		Monongehela, Pa.
			G. A. & F. C. Wagman, Inc.	Dallastown, Pa.
			James Julian	Elsmere, Delaware
			J. Richard Nissley	Landisville, Pa.
204	24-C	John H. Swanger, Inc.		Lancaster, Pa.
205	23-B	H. J. Williams Co., Inc.		York, Pa.
			H. T. Osburn & Co., Inc.	Franklin, Pa.
206-7	22-C-B	Booth & Flinn Co.		Pittsburgh, Pa.
			Bethlehem Steel Co.	Bethlehem, Pa.
			C. S. Stetler—Steel Erector	New Cumberland, Pa.
208	21-A-2	J. Robert Bazley, Inc.		Pottsville, Pa.
			Brown, Davis & White	Lebanon, Pa.
209	23-A	C. J. Langenfelder & Son, Inc.		Baltimore 12, Md.
			G. A. & F. C. Wagman, Inc.	Dallastown, Pa.
			J. Richard Nissley	Landisville, Pa.
210	24-A	Harrison Construction Co.		Pittsburgh, 12, Pa.
			Allegheny Asphalt & Paving Co.	Pittsburgh, Pa.
			Stewart & March Inc.	York, Pa.
			Williams Paving Co., Inc.	Norfolk, Virginia
211	23-A-1	John H. Wickersham Eng. & Construction, Inc.		Lancaster, Pa.
212	27-B	S. J. Groves & Sons Co.		Downingtown, Pa.
			Kingston Contracting Co.	Lattimer Mines, Pa.
213 & 214	27-C & 28-A	The Lane Consturction Corp.		Meriden, Conn.
			A. R. Coffeen	Decorah, Iowa
			G & H Steel Service Inc.	Drexel Hill, Pa.
			Henkels & McCoy	Philadelphia, Pa.
215	25-A	H. J. Williams Co., Inc.		York, Pa.
			H. T. Osburn & Co., Inc.	Franklin, Pa.
216	25-B	Ralph Myers Contracting Co.		Salem, Indiana
			C & T Construction Co., Inc.	Collinswood, N. J.
			Brayman Construction Co.	Bellvue, Pgh., Pa.
			Harry C. Erb, Inc.	Philadelphia 2, Pa.
217 & 218	28B-1 & 2	L. G. Defelice & Son, Inc.		North Haven, Conn.
			Mauger-Smith Co.	Columbus, Ohio
			Conduit & Foundation Corp.	Philadelphia 46, Pa.
			Polselli & Angelucci	Philadelphia, Pa.
			Henkels & McCoy	Philadelphia, Pa.
			Allied Painting Constr. Inc.	Worcester 8, Mass.
219 & 220	25-C & 26-A	C. W. Good, Inc.		Lancaster, Pa.
221	21-B-1	Johnson, Drake & Piper, Inc.,		New York, N. Y.
			Harrison Construction Co.	Pittsburgh 21, Pa.
222 & 223	21B-2 & 22A-1	Central Pa. Quarry Stripping & Construction Co.		Hazleton, Pa.
			Reed & Kuhn	Elysburg, Pa.
			Williams Paving Co., Inc.	Norfolk, Virginia
224	21A-1	Frank Mashuda Co.		Portersville, Pa.
			J. Richard Nissley	Landisville, Pa.
			Allegheny Asphalt & Paving Co.	Pittsburgh, Pa.
			A. R. Coffeen	Decorah, Iowa
225	22-B	Patterson Construction Co.		Monogahela, Pa.
			G. A. & F. C. Wagaman, Inc.	Dallastown, Pa.
			Pierson Contracting Co.	Saginaw, Mich.
226	26-B	Loyalhanna Contracting Co.		Carnegie, Pa.
227 & 228	26-C & 27-A	C. J. Langenfelder & Son, Inc.		Baltimore, Md.
			Koppers Co., Inc.	Baltimore, Md.

CONTRACT NO.	TYPE OF WORK	NAME OF CONTRACTOR	ADDRESS
242	Fabrication of Toll Booths and Canopies	Taller & Cooper	Brooklyn, 1, N. Y.
230 to 237	Utility Bldgs., Plaza and Erection of Canopies	B. D. & W. Inc.	Carlisle, Pa.
230A to 237B Inc.	Plumbing & Heating	John A. Galbreath	Pittsburgh, Pa.
		Ramsey's	Harrisburg, Pa.
		Charles S. Reese	Lancaster, Pa.
		Bates Brothers	Lansdowne, Pa.
		Bowers Bros. Co.	Philadelphia, Pa.
230C to 237C	Electrical System	Keystone Engineering Corp.	Philadelphia, Pa.
Inc.	Communication System	Raymond Rosen Eng. Prod. Inc.	Philadelphia, Pa.
238 to 241	Maintenance Bldgs.	H. B. Alexander & Son, Inc.	Harrisburg, Pa.
		D. S. Warfel	Lancaster, Pa.
		Ritter Bros.	Harrisburg, Pa.
238A to 241B	Plumbing & Heating	Ramseys	Harrisburg, Pa.
		Charles S. Reese	Lancaster, Pa.
		Bowers Bros. Co.	Philadelphia, Pa.
		Bates Bros. Co.	Philadelphia, Pa.
238C to 241C	Electrical	George L. Buck	Reading, Pa.
243	Right-of-Way Fence	Webster & Webster, Inc.	East Hartford, Conn.
244	Guard Rail & Curbing	Henkels & McCoy	Philadelphia, Pa.

Bridges on the Pennsylvania Turnpike System

By Knud H. Jensen, Bridge Engineer
Pennsylvania Turnpike Commission

THE PENNSYLVANIA Turnpike System includes three hundred seventy-eight (378) bridge separations, two hundred seventy-four (274) stream and drainage structures, a total of six hundred fifty-two (652) structures which were necessary to carry the four-lane divided highway from Philadelphia to the Ohio State line.

The largest single structure on the Philadelphia Extension is the Susquehanna River Bridge, carrying the Turnpike across the Susquehanna River from York to Dauphin County. This structure was designed by Parsons, Brinckerhoff, Hall & MacDonald of New York City. The Contractor was Booth and Flinn Company of Pittsburgh, who used a unique technique which heretofore has never been used in any construction of such bridge. Instead of the usual cofferdams, two roads were built from shore to shore, with intervening drainage openings. To enable construction equipment to travel both sides of the structure, connecting fills were made at each pier so that only pumps were needed to keep the excavation dry.

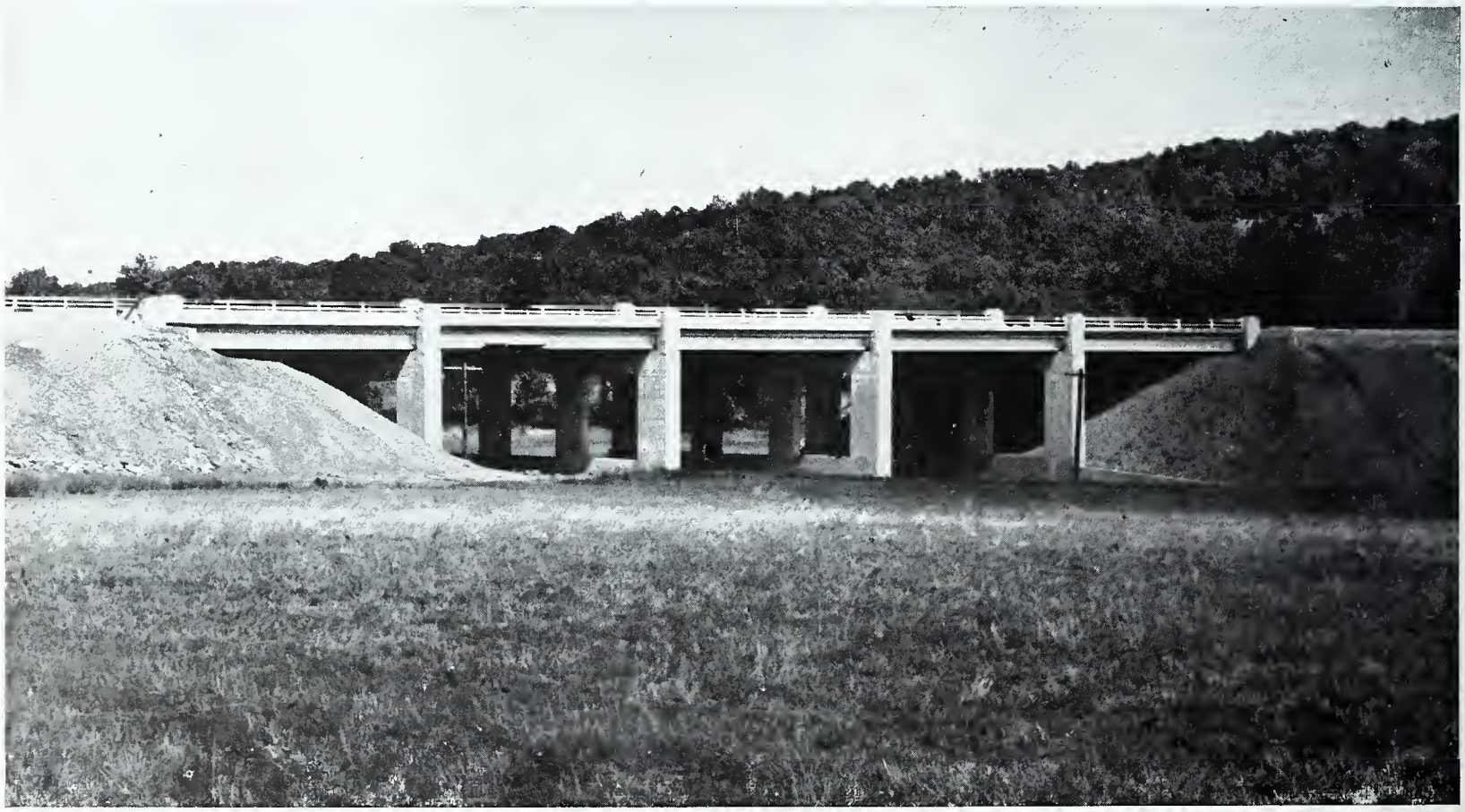
In addition to the Susquehanna River Bridge, two major stream crossings were

made on the Philadelphia Extension of the Pennsylvania Turnpike System. These are the Swatara Creek Bridge and the Yellow Breeches Creek Bridge, both designed by Modjeski and Masters, one of the outstanding Bridge Designers in the world.

Major structures on the Western Extension of the Pennsylvania Turnpike System include the Allegheny River Bridge, designed by Modjeski and Masters, the Beaver River Bridge, designed by George S. Richardson, and the Brush Creek, Plum Creek and Willow Run Viaducts, designed by Parsons, Brinckerhoff, Hall and MacDonald. These structures, in addition to numerous small bridges, will carry the four-lane divided highway from Irwin, the present terminus of the Pennsylvania Turnpike, to the Ohio State line, at a point approximately fourteen (14) miles southwest of Youngstown, Ohio.

Plans for all these structures are supervised in our offices. Many modifications and changes are made from time to time, as actual construction proceeds.

The workmanship as well as the progress of the construction has been quite satisfactory in spite of all the difficulties encountered. This result has been possible only through the good will and cooperation of the Contractors and other parties involved in the construction of these structures.



Steel bridge with concrete facing on Philadelphia Extension near Hopeland, Pa.

Bridge Engineering on Philadelphia Extension of Pennsylvania Turnpike

By Modjeski and Masters, Consulting Engineers, Harrisburg, Pa.

THE EASTERN Extension of the Pennsylvania Turnpike includes a total of 193 new bridge structures between Middlesex and King of Prussia. Among these are three major stream crossings. and over the Susquehanna River between Cumberland and Dauphin Counties, another over the Yellow Breeches Creek between Cumberland and York Counties and the third over Swatara Creek in Dauphin County. The remaining 190 structures meet various requirements, carrying the Turnpike over numerous streams and separating the grades of the Turnpike from all of the intersecting primary, secondary and rural highway routes and railroads serving the area through which the 100 mile extension passes.

Bridges are the key factor in the design of such a facility as the Turnpike. It is only through their use that it is possible to provide for free and uninterrupted flow of traffic over or under existing arteries, the continuity of which must be preserved.

Modjeski and Masters were retained by the Pennsylvania Turnpike Commission, under one agreement, to perform any and all engineering services requested in the checking of designs of bridges, contractors' methods of construction, plans for falsework, shop drawings and detail plans for 190 of these structures.

Under another agreement, Modjeski and Masters were retained to prepare contract plans and to advise in the supervision of construction of two of the major structures, one over Yellow Breeches Creek and the other over Swatara Creek.

The Susquehanna River Bridge was designed and the detail plans were checked under a separate agreement by other Consulting Engineers.

The original determination of location of structures and of the type and general requirements to be fulfilled by them was made in the offices of the Turnpike Commission under the direction of Chief Engineer, R. B. Stone. This was done on the basis of preliminary surveys, designs and estimates of the entire Extension, completed as a part of the initial task of establishing its feasibility and detailed alignment.

Contract plans for the 190 bridges were prepared in the offices of the three consulting engineering firms who prepared road designs for the three main sections of the Extension. These plans were submitted to Modjeski and Masters for detailed review and general checking before being incorporated into their respective construction contracts. In this manner, the work of the road consultants was coordinated and standardized, as was necessary to obtain the integrated overall project.

All the bridges were designed under the 1944 Standard Specifications of the American Association of State Highway Officials for H20-S16 loadings.

Steel was required to be copper bearing, generally, except where silicon steel was specified. Designs were based on 18,000 lbs. per square inch unit stressin all steel except silicon in which the permissible was 24,000 lbs. per square inch.

In riding over the Philadelphia Extension, it will be noted that there are many instances of the use of the familiar reinforced concrete rigid frame type of structure which was used extensively on the original Turnpike (these spans being flanked with a variety of abutment and parapet treatments. However, there was an increased tendency toward the use of long continuous rolled-beams for special crossings, similar to the general design used for the Yellow Breeches Creek Bridge, which is described in following paragraphs. This is illustrated in the 419 feet long, continuous, rolled-beam bridge over Cocalico Creek. In this Lancaster County bridge, the rolled-beams are supported on reinforced concrete bents and have a maximum span of 90 feet.

The longest reinforced concrete arch on the Eastern Extension is the crossing of Hammer Creek in Lancaster County with a span of 62 feet.

Foundation conditions along the Eastern Extension were extremely variable, including limestone, shale, sandstone and hardpan, occasionally readily accessible; but often overlain with sand or clay to such depths that spread footings were occasionally used. Many of the structures are supported on piles, or on pedestals, or on cylinders sunk to rock.

The designs of smaller bridge structures generally followed the practice which has been standardized by the Highway Department and the Pennsylvania Turnpike Commission. In general, they presented few special new problems in design or to the contractors in the field.

On all of the bridges the two-lane roadways are carried through at a width of 24 feet in each direction. Median strips are laid out on the large majority of structures at the normal ten feet width maintained along open stretches of the Turnpike. On these structures a shoulder width of six feet is provided on each side.

On the major bridge structures, and on minor structures in the vicinity of these major crossings, the median strips are narrowed from ten feet to four feet. On these the six foot shoulder width is decreased to provide two feet of gutter space along the curbs. This decreased width of median and shoulders was adopted in the interests of economy, and the normal ten foot median strip is tapered gradually along the highway to provide easy transitions to and from these slightly narrowed major crossings.

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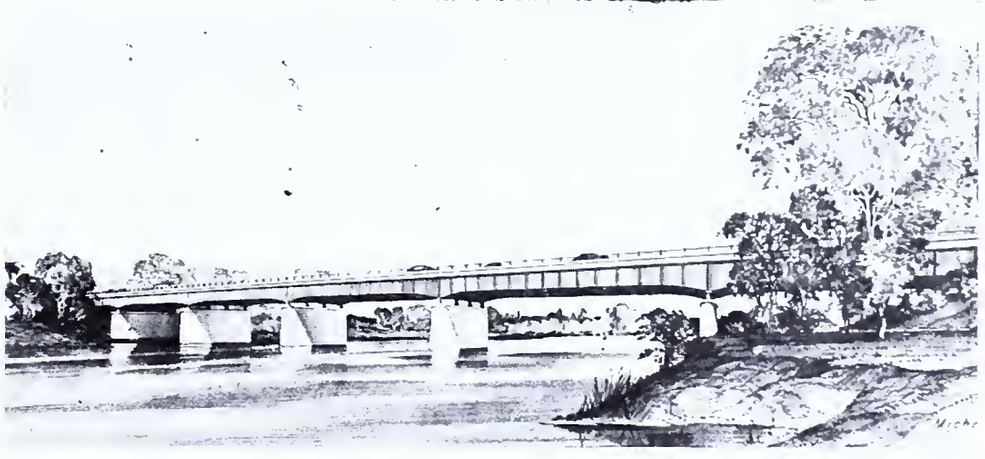
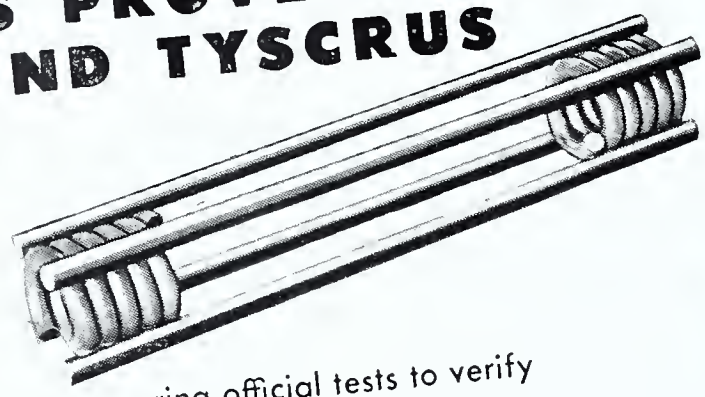


Swatara Creek Bridge on the Philadelphia Extension of the Pennsylvania Turnpike System. Designed by Modjeski and Masters, Consulting Engineers.

IMPARTIAL TESTS PROVE STRENGTH OF RICHMOND TYSCRUS



Richmond pioneers again . . . sponsoring official tests to verify the rated safe loads of its Form-tying Products. In every one of 181 tests conducted by Charles E. Schaffner* at Brooklyn Polytechnic Institute, the results indicate a huge margin of safety, with ultimate strength far beyond the published safe load.

TYSCRU SIZE	PUBLISHED SAFE LOAD	REPORT OF ULTIMATE LOAD Test No. 1	Test No. 2
½" Dia.	6000	9,490 lbs.	10,590 lbs.
¾" Dia.	12000	19,720 lbs.	20,570 lbs.
1" Dia. 2 Strut	18000	27,580 lbs.	27,820 lbs.
1" Dia. 4 Strut	24000	37,930 lbs.	36,890 lbs.
1¼" Dia. 4 Strut	30000	55,270 lbs.	56,790 lbs.

*Assistant Professor of Civil Engineering

RICHMOND KNOW-HOW—DEPENDABILITY—SERVICE—ESTIMATES & JOB PLANNING

The Design of Turnpike Interchanges

By Robert W. Lowry, Vice President
Capitol Engineering Corporation

WE of the Capitol Engineering Corporation are proud of the part we were privileged to play in the engineering design of the Pennsylvania Turnpike. Subsequent to the legislative approval of the Philadelphia Extension and later, the Western Extension to the original Turnpike, we were called upon to render the necessary surveys and design engineering of many miles of turnpike roadway, traffic interchanges and bridge structures. Our work involved the field survey and office design of turnpike main line and intersecting highways through the counties of Cumberland, York, Lancaster, Berks, Chester, Lawrence and Beaver, for a total of nearly 60 miles, including six traffic interchanges and approximately 125 bridge structures of various types and sizes.

As a contribution to this dedication number of "Highway Builder" we have been invited to prepare a short article covering that which we consider to be one of the most intriguing and interesting phases of our highway engineering work — the design of turnpike interchanges. We have designed the following interchanges on the Philadelphia and Western Extensions of this great highway project, which has rightfully earned its title of "The World's Finest Highway":

Gateway Interchange — Ohio Border, Lawrence County

Beaver Interchange (Homewood) — State Route 18, Beaver County

Carlisle Interchange (Middlesex) — U.S. Route 11, Cumberland County

Gettysburg Pike Interchange — U.S. Route 15, Cumberland County

Harrisburg—West Shore Interchange (York) — U.S. Route 111, York County

Morgantown Interchange — U.S. Route 122, Berks County

The Pennsylvania Turnpike interchanges may be considered as "gateways" to the World's Finest Highway, as well as exits to distributor roads that are as the veins that connect this great traffic artery to the entire highway system of the Commonwealth of Pennsylvania and adjoining states.

As the interchanges carry the life blood of traffic to the great artery and send it back to the veins of the state highway system, they must provide for ready and easy merging of traffic from the turnpike to state highways and the diverting of traffic from state highways to the turnpike without friction. They must be made safe, convenient and inviting passageways to a unique driving adventure.

The final design of a major interchange involves the analyses and application of controlling design factors through a procedure of revision, variation, adaptation and refreshment of a preliminary study chosen from a number of possible layouts for the particular area being considered. The first step is the site selection of the proposed interchange of traffic between the turnpike and one or more important roads. Topography and the origin and destination of traffic are major controls.

There is a striking difference between an ordinary grade separation interchange of two or more major roads with ramp connections and a turnpike interchange. Two toll free major roads might be handled by a conventional clover leaf design, but a full interchange between the turnpike and a major road must provide for toll collection facilities in addition to the normal free traffic flow without conflicting turns or crossing of traffic lanes. In order to funnel the entering and leaving traffic through the toll collection facilities without any movement confliction on a full interchange, it is neccessary to provide three grade separation structures, or the equivalent thereof

After selection of the general site for an interchange, it must be determined whether the present site of the major highway is suitably located, or whether a

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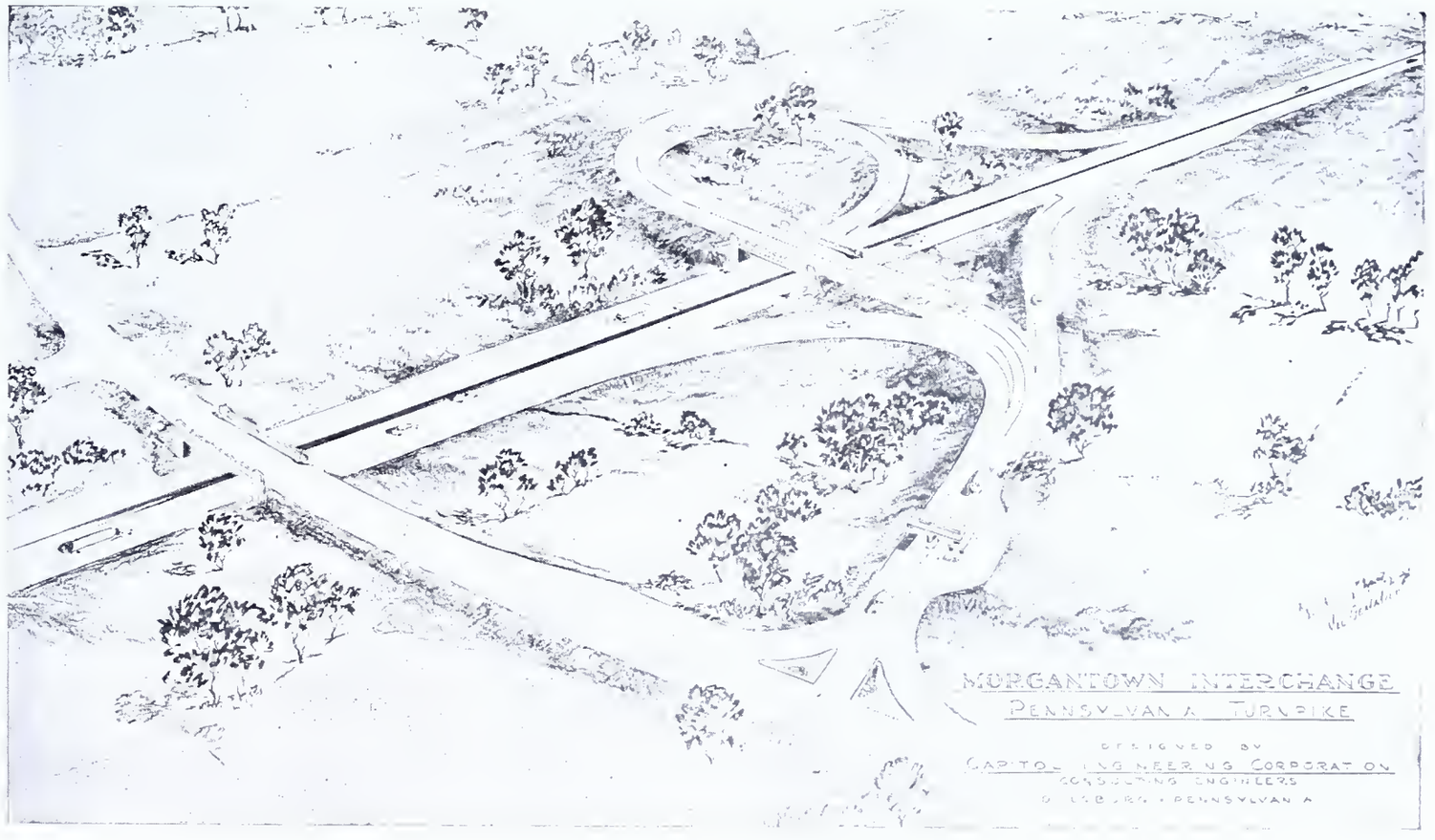


On the Philadelphia Extension . . . Pennsylvania Turnpike System

Contract 202, Section 24-B
Lancaster County 4.36 Miles

Contracts 219-220, Sections 25-C & 26-A
Lancaster County 8.53 Miles

We are pleased to have had a part in the construction of this great highway

GOOD CONSTRUCTION CO., INC.
LANCASTER, PA.

The Newly Designed Delineators or Reflectors For the Philadelphia Extension of the Pennsylvania Turnpike

By Alexander R. Chambers

ONE OF THE many improvements for increasing the safety of the motorists on the Philadelphia Extension of the Pennsylvania Turnpike will be the newly designed delineators or reflectors. To those many hundreds of thousands of motorists from all corners of the United States and Canada, no explanation of the term "delineator or reflectors" on the Pennsylvania Turnpike is needed. They know that regardless of "how foul the weather," whether it be rain, fog, snow, or sleet, the path across the Turnpike is delineated or marked at night as well as day. The head lights of their cars light up a path delineating the outline of the Turnpike. For those thousands of other motorists who hope and plan to travel the World's Finest Highway, we will explain and describe the purpose of, the action of delineators, and the construction of the newly designed delineators.

Foul weather, rain, fog, snow, or sleet has always been dangerous to motorists —particularly at night, and especially if the highway is designed for high speed travel. To help the motorist in all kinds of weather to keep traveling safely at a reasonable rate of speed, authorities have provided different means of outlining or delineating the roadway. The most modern and efficient way of outlining the concrete pavement so that the motorist has the highway clearly delineated for over 1000 feet ahead at all times, is the use of deflectors or delineators. Along the tangents (straight stretches) of the Pennsylvania Turnpike there is a delineator every 200 feet on the shoulders to the motorist's right and in the center strip. On the curves, the distance between the delineators is 100 linear feet. As explained, the purpose of delineators is to show the motorist the outline of the road even in the foulest weather. To do this appears easy. However, there are always problems which must be considered. If electric lights strong enough to outline the road could be installed, the problem would be easily solved. However, the cost is prohibitive as the Pennsylvania Turnpike when completed will cover some 325 miles. Such an installation can be easily seen to be impracticable. Another problem is to have the delineator or reflectors sharp enough to give light or reflection, yet not too sharp to cause glare. In some cases, the glare has been

so great that motorists' eyes are effected many hours after they have passed them by.

In designing the new delineators, all the above problems were considerd by the Turnpike Commission and their engineers. After some years of field experience of placing different sized and different colored reflectorized material on the Turnpike, it was decided to make the new delineators exactly the same size and dimensions as those on the original section of the Turnpike. Aluminum was chosen as the metal to use for the delineator so as to reduce to a minimum the corrosion and dis-colorization that comes from rusted metal. It was also decided to use aluminum nuts, bolts, and other accessories for the same reason. The newly designed delineator is a sheet of aluminum ⅛" thick, 7¾" long, 3½" wide, with the four corners cut off at a 45° angle. On one side of this sheet of aluminum there is laminated by the vacuum steam process signal silver Scotchlite Reflective Sheeting.

What is Scotchlite Reflective Sheeting? "Scotchlite" Reflective Sheeting is a reflector — and like any other reflector, it depends on light striking its surface to make it shine. But here is where the similarity ends, for this Sheeting has important qualities and advantages that make it unique — different from everything else.

What It Looks Like — "Scotchlite" Reflective Sheeting is thin and flexible. The back is smooth — the front, or reflecting side, is lustrous and has a "glassy" feel.

How It Works — "Scotchlite" Reflective Sheeting is a reflex reflector — which simply means that it reflects light directly back to the source of light. This is different from most surfaces which either absorb light or let it bounce off in some other direction. "Scotchlite" Sheeting, instead of letting these rays bounce off, gathers them in and reflects them right back to where they came from. This "gathering" and return of light is brought about by thousands of tiny glass lenses bonded to the surface of the Sheeting. When beams from headlights strike this even-textured surface, these microscopic "lenses" break up the light into thousands of smaller beams that are reflected directly back to the driver. The result is a glareless brilliance, many times brighter than the best white painted surface. The signal silver Scotchlite reflectors on the Turnpike will have approximately 235 times the reflectivity of the best white paint.

How It Is Used — "Scotchlite" has found outstanding uses in wide variety of applications. Among these are traffic signs, highway bulletins, trucks, buses, automobiles, bicycles, railroad boxcars, bridge abutments, guard rails, license plates, trailers, home signs and numbers, in mines, and in countless other ways and places.

With this amazing Sheeting it is possible to reflectorize not only points or spots on a surface, but to completely outline, delineate or over-all reflectorize an object or surface — and to do this in color.

Scotchlite material has a record of success. The large automobile companies have been using it on their dealer billboard advertising signs for years. Railroads are using it quite extensively as a safety signal measure. During World War II all Scotchlite material was requisitioned for use by the Armed Forces on land and on sea. The state of Connecticut has Schotchlited all automobile and truck license plates. Schotchlite material on account of its wonderful record made Readers Digest in the issue of September 1948 in an article entitled

(Continued on Page 134)

How The Turnpike System Began

By A. E. O'Brien, Executive-Secretary Associated Pennsylvania Constructors

COMPLETION of Pennsylvania Turnpike's Philadelphia Extension provides an opportune occasion to recall the background and conception of the original idea for a great superhighway spanning Pennsylvania from Irwin to Middlesex.

What is fast becoming a complete system of streamlined, limited-access highways stretching to many strategic centers of the Commonwealth had its inception deep in the mountain hinterland which had challenged many generations until an economic depression fired the imagination of a small group of far-sighted Pennsylvanians.

In 1933 Edward H. Flickinger, then Chief of City Planning in the Pennsylvania Department of Internal Affairs, set out one day to look over his boyhood haunts in Path Valley, where his great-great-grandfather, Captain John Flickinger, had settled after serving in the Continental Army. As a boy, with his brother Joseph, Flickinger had played on the right-of-way of the projected South Penn Railroad and had heard from his grandfather, Dr. John Statler Flickinger, many tales about the earlier attempts to tunnel the Alleghenies.

As early as 1837 a company of surveyors had invaded Path Valley in West Franklin County to locate a suitable right-of-way for a rail connection between the Cumberland Valley and the Ohio River at Pittsburgh. The next forty years saw the arrival of six other groups of surveyors attempting to establish a south tier railroad right-of-way, but after an expenditure of over $300,000 the venture remained little more than a dream.

In 1883, however, William H. Vanderbilt, then at the peak of his brilliant career as guiding genius of the New York Central, with the cooperation of manufacturers in Western Pennsylvania, formed a syndicate involving nearly $200,000,000. Plans were mapped for a 209 mile right-of-way from Harrisburg to Pittsburgh, passing through the Flickinger tract in Path Valley, using nine tunnels to avoid scaling the Allegheny peaks. Work began at once to carry out a dream of nearly fifty years.

Two years later more than sixty percent of the gigantic task was finished on the single-track railroad that was to link Harrisburg and Pittsburgh. In mid-summer of 1885 work stopped one evening as usual; it was never resumed. The South Penn's death warrant came with a bewildering suddenness which dazed the

personnel and the people of Path Valley.

For the next fifty years the long, level straightaways; the huge drains, arched in perfect stone masonry; the massive tunnels, partly bored, stood as mute reminders of the herculean struggle of the 19th century railroad giants, pathetic monuments to the $10,000,000 railroad that never turned a wheel.

Here at the foot of Tuscarora Mountain Edward Flickinger, as a boy, had hid in the great culverts, explored the abandoned tunnels and tramped on the watergrade right-of-way. Here in 1933 as an employee of the Commonwealth his thoughts turned to worthwhile public works. That year, government agencies were seeking projects that would employ idle millions and set the wheels of industry turning.

An ambitious dream began to take form in Flickinger's mind: This very right-of-way would become a superhighway of travel and commerce; its nine mountain tunnels would speed highway traffic and protect motorists from the fog and sleet of high Allegheny altitudes.

Upon returning to Harrisburg, Edward Flickinger found the idea haunting his idle moments. Such a highway he reasoned, would offer great safety; its easy grade would make it ideal for heavy commercial traffic; its isolated route would assure speed; and certainly, in this day of motorized military units, it would be a national boon in the event of war. He discussed the idea with Norman Stiteler who in turn revealed it to Victor Lecoq and Sidney Snow, then attached to the State Planning Board. This is the first instance in which a superhighway following the old South Penn routes ever was proposed.

So colossal an idea and so gigantic an undertaking required support and development beyond the small Commonwealth bureau with which Flickinger was identified: the late William A. Sutherland, then general manager of the Pennsylvania Motor Truck Association; Norman B. C. Stiteler, then of the Portland Cement Association; the Hon. Clifford S. Patterson, then a member of the Pennsylvania General Assembly from Washington County and A. E. O'Brien, Executive-Secretary of Associated Pennsylvania Construction.

Serious discussion ensued immediately and careful plans were made to advance the proposal. Step by step Flickinger's dream began to assume form and substance as other men learned the possibilities and added their support to the idea. In 1935 Associated Pennsylvania Constructors published the first articles on "The Dream Highway" in its official publication, HIGHWAY BUILDER.

On April 23, 1935, Resolution #138 known as the "Patterson Resolution" was introduced in the House of Representatives. This Resolution provided for a study and investigation of the feasibility of this project. Later in this Session it was reported to the floor and was passed by both the House and Senate. Upon the passage of this Resolution, Representative Patterson was named to head the Commission. Its membership consisted of Ealy of Somerset, Mallory of Blair, and Rupp of Lehigh from the Senate, and O'Keefe of Allegheny and Sheroek of Somerset from the House. No appropriation was made for the work of the Commission, but the same year a grant from the W. P. A. was used in conjunction with Department of Highway funds for a survey of the right-of-way. Through the Commission and the cooperation of W. P. A. Administrator Edward N. Jones and the Secretary of Highways Warren Van Dyke, the survey and studies were arranged and proceeded.

With the study and preliminary surveys completed in 1937, the Joint Legislative Committee made its report. This was very complete in detail — suggesting route; number of miles; length of tunnels; proposed interchanges; width of right-of-way; two lanes of traffic in eaeh direction; medial divisor of from 7′ to 10′; 10′ shoulders; grades not to exeeed 3 per-

(Continued on Page 110)

Construction Equipment Distributors and The Turnpike

By S. John Oechsle, President, Metalweld, Inc.
Director, Region 3, Associated Equipment Distributors

THERE CAN be no question of the part that the Construction Equipment Distributors played in the construction of the Pennsylvania Turnpike. Today, with equipment replacing labor, contractors are faced with the problem of purchasing and, to a great part, maintaining, many large and expensive pieces of machinery. Equipment estimates run well into the millions of dollars for many of the highway building organizations.

The types and sizes of machines on a job of this magnitude stagger the imagination and is a tribute to American ingenuity and know-how. The machinery used on the Turnpike has literally made it an easy task to lower mountains, fill valleys, cross rivers and cut through forests and swamps. When it is realized that these huge machines, which load and carry a full carload of earth and rock and the tractors that really push mountains before them, are usually operated by only one man, it is truly a compliment to American engineering and design. Behind these gigantic machines we find the Manufacturers and Distributors of Construction Equipment.

The part of the Manufacturer of construction equipment is multifold. Their engineers must all keep in constant touch with the growing needs of the contracting trade to build larger and better equipment. Most jobs require, or could be more economically completed with a new type of tool or an old unit redesigned to fit a particular need. The Manufacturers must and do constantly ask themselves — what changes can we make or incorporate to make this machine do more work — what can we do to combine two or more operations into one? How can we do this job faster, better, and cheaper than it is now being done? In the event that the idea or principle is practical and the Industry could use, through increased production or speed of job completion, enough machines for sales to warrant cost of production, the Manufacturer will engineer to a point of practicability and place the machines on the market for general use. Another aspect of the part played by the Manufacturer is that of constantly striving to better his machinery. By that we mean the mechanical improvements for longer life, less maintenance, increased production, and lower cost for more rugged duty than his machine has ever been asked to perform.

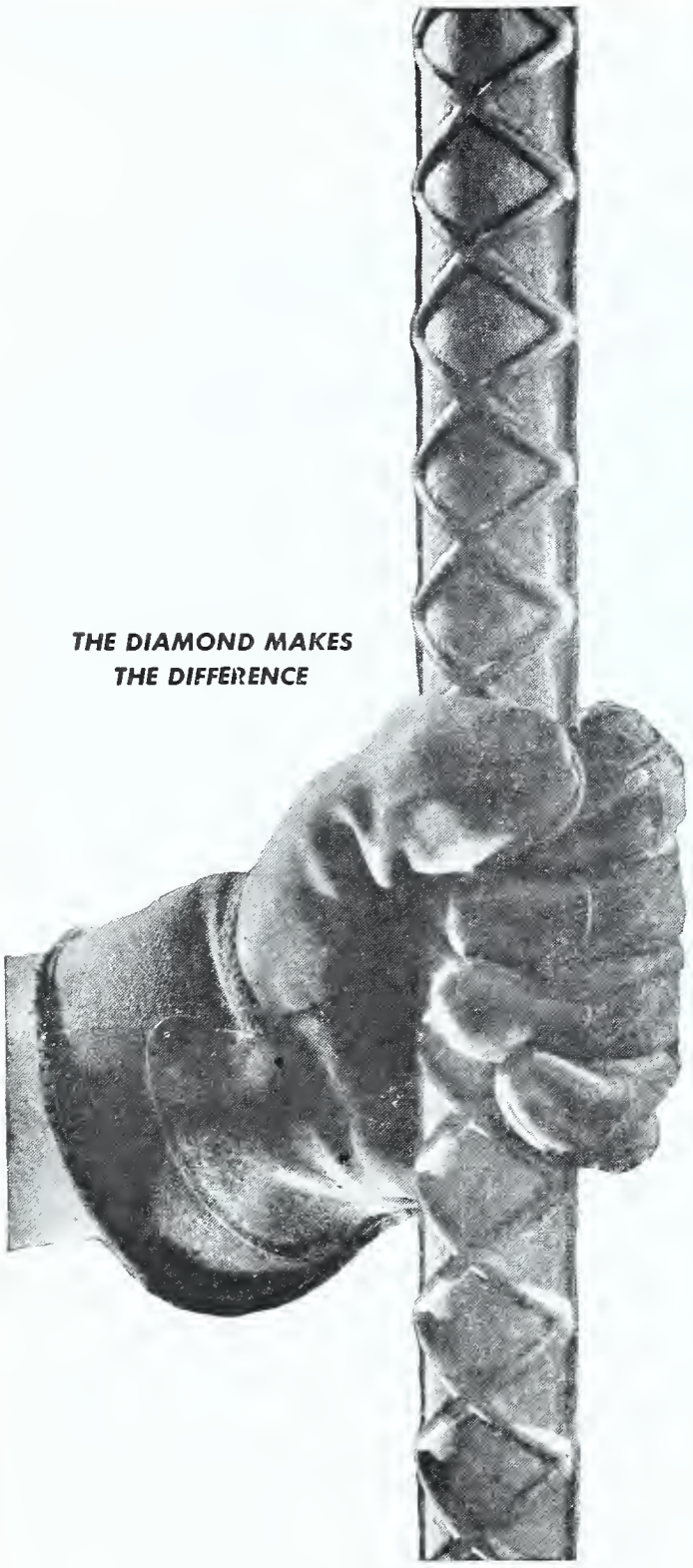
The Pennsylvania Turnpike and other jobs all over the country are the birthplaces of ideas and the proving ground of their merit. This is where the connecting link between the Manufacturer and the Contractor enters the picture. It is the Construction Equipment Distributor. Without this important link, it would be extremely difficult and considerably more expensive for the Manufacturer to contact all of the Construction Contractors to present their sales story and also to render the necessary services which follow the sale. With the number of varied types of machinery on the market today, it would be impossible for the contractor to keep abreast at all times of new developments. It is of prime importance that these modern developments be brought to the attention of the user and this is one of the principal tasks undertaken by the Construction Equipment Sales Organizations.

The training of men to serve the need for sales and service of new equipment for the replacement of old equipment is quite important. These salesmen must study and be constantly familiar with their products and the products of their competition and all new developments that might aid their contacts in any way whatsoever. When and if the customer decides to buy, the salesman must be able to arrange the method in which the sale will be made, i. e. as to cash or finance, and, with taxes and costs going constantly higher, the terms of the sale must also meet the requirements of the buyer. Today, arranging financing is a major function of the Construction Equipment Distributor. In general, he must handle the finance papers himself or bring together finance organizations and the prospective buyer. After all these details are taken care of, the Construction Equipment Distributor's main job comes to life. He must see to it that the machine operates to the satisfaction of the user and assures him that any down time will be kept to a minimum. In general, this is the part of sales known as "Keeping the customer sold" and is handled by the Parts and Service Departments. These two sections are an integral part of any first-class construction equipment sales organization.

The Construction Equipment Distributor is a most important link in the chain, a part which brings the manufacturer and contractor together. There are many reasons why the Sales and Service organizations are so important, among them, maintenance service. It is important for the Contractor and also for the Manufacturer to see that the company from whom they buy or who represents them maintains an adequate stock of parts or be able to obtain them in very short order. They must have a repair organization to handle the service work. These repairmen are well trained in the field so they can perform their jobs efficiently and promptly. This important factor keeps down time for the contractor to a minimum as this can be a very vital item with today's schedules and labor costs and this detail should be well taken into consideration in the purchase of any equipment. Many of these repair jobs must be done at night or on weekends, therefore, the Distributor must have men willing to spend those hours doing a good job. These servicemen also report to the Manufacturers any defects in equipment and see to it that the corrections are made with or without cost to the Contractor.

In cooperation with the Distributors, most Manufacturers maintain field service and sales engineers. These men work hand-in-hand with the Distributor and the Contractor to improve and maintain the operation of units in the field. Through this group, ideas channel to the Design Engineers and from there to Production and from Production to the User. In this way, the Manufacturer and the

(Continued on Page 142)



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UNITED STATES STEEL

Pittsburgh Hails The Pennsylvania Turnpike

By Park H. Martin, Executive Director Allegheny Conference on Community Development

PITTSBURGH, world capital of steel and the metals industry, is in the midst of a vigorous and energetic growth, — both from a social and economic standpoint.

One of the most important projects contributing to this era of new development in the Pittsburgh district is the extension of the Pennsylvania Turnpike, — the extensions eastward to Philadelphia and westward from the outskirts of Pittsburgh to the border of the State of Ohio.

The story of Pittsburgh's rise from a frontier town to The Steel Capital is closely related to the development of highways and roads for the transport and exchange of goods and commodities between the east and the west.

Forerunners of the Pennsylvania Turnpike

By the end of the Revolutionary War in 1781 Pittsburgh was still a small frontier outpost with perhaps fifty log houses located near the Point, where the Allegheny and Monongahela Rivers join to form the Ohio.

From that time on the city grew in importance not only as the center of western Pennsylvania, but as The Gateway to the West.

A vital factor in the emergence of Pittsburgh was the construction of the old Forbes Road across the Allegheny mountains via Bedford, known today as the Lincoln Highway. Over this vital artery frontiersmen drove their pack horses loaded with seeds, salt, dry goods, hardware and other essentials needed in building a new way of life.

As the frontier moved westward Pittsburgh buzzed with activity and enter-

prise, inaugurating a new era of river transportation, — the era of flatboats and keelboats. Flatboats were in wide demand to carry merchandise to the south, while the keelboat was in use for upbound traffic.

However, it was "The Road," the old Forbes Road, that was largely responsible for civilization taking root in Pittsburgh. The tide of migration to the West flowed across Pennsylvania over The Road, to the rivers at Pittsburgh.

At the turn of the century The Road gained in importance as the pack horse with its limited capacity gave way to the Conestoga wagon for cross-mountain hauls. This sturdy vehicle of pioneer invention played a significant role in Pittsburgh's early history. Generally drawn by a powerful six-horse team, the Conestoga wagon, or prairie schooner as it was often called, made the round trip between Philadelphia and Pittsburgh in from six to ten weeks' time. With the improvement of roads, fast stagecoaches came into existence, which made the trip in from two and one-half to four days.

Erie Canal

When New York built the Erie Canal, Pennsylvania lost some of its initial advantage as the leading state in the country in population and economic development. The ensuing years saw New York City surpass Philadelphia in size, while the Erie Canal became a main artery in the movement of goods from the New West to the East and the eastern seaports for export abroad.

The Pennsylvania Turnpike: Restoration of The Road

Now The Road is being restored. With the completion of the Pennsylvania Turnpike from border to border, the Commonwealth will once again have the best route between the East and West. This unbroken east-west free-flowing highway, which follows in general the route of the old Forbes Road, is a major factor in the continued growth and expansion of industry and business in the Pittsburgh district, as well as in the state as a whole.

Economic Advantage

Today the cost of transportation is one of the principal items in the cost of doing business. In seeking new locations for plant sites and in embarking on expansion programs, industry and business

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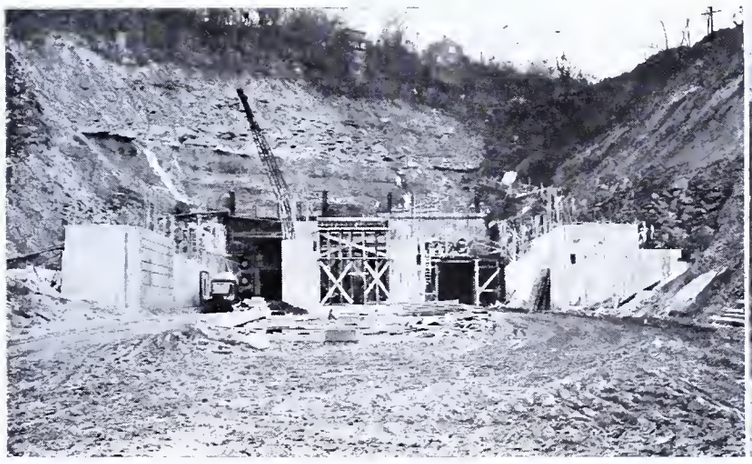


Penn-Lincoln Parkway, Squirrel Hill Tunnel . . . . A spectacular engineering project on the Penn-Lincoln Parkway East is the Squirrel Hill Tunnel, a 4,225 foot twin-tube tunnel under one of the city's most heavily populated residential areas. The boring through has been completed.

Penn-Lincoln Parkway . . . Pittsburgh's Penn-Lincoln Parkway will carry Routes #22 and #30 into and through the city and will link via #22 and #30 with the western extension of the Pennsylvania Turnpike. This section is now open to traffic.

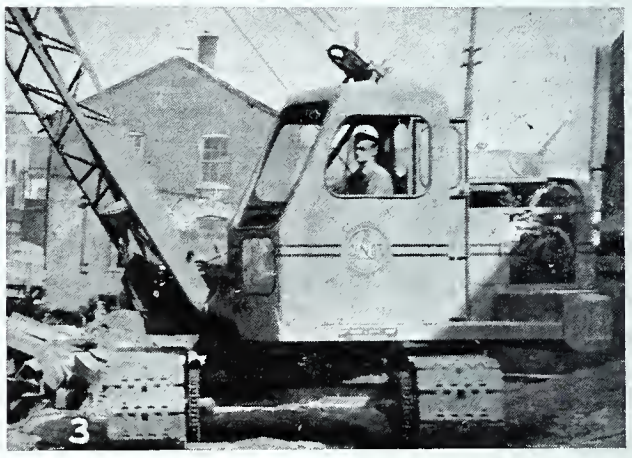
J. Richard Nissley's Contribution

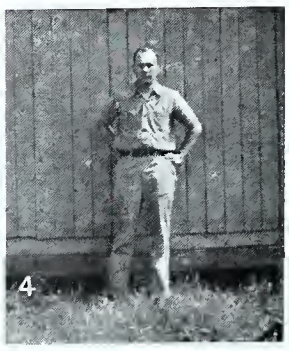
Structure on Section 23-A, Middletown, Pa. Constructed under sub-contract from G. A. & F. C. Wagman and C. J. Langenfelder & Son.

Plate Girder bridge at Lawn, Pa., constructed under sub-contract from G. A. & F. C. Wagman and Frank Patterson, Section 23-C.

T-Beam Structure on C. J. Langenfelder Section 23-A at Middletown, Penna.

Here are the structures we completed on the Turnpike, and the men who built them.





1. Paul L. Hackman, General Foreman on Sec. 23-A, C. J. Langenfelder Section.
2. George Douglas, General Foreman on Frank Mashuda Section 21-A-1.
3. J. Clayton Bowers, Master Mechanic.
4. Ben F. Stoner, Office Manager.
5. Richrad Kahler, Engineer and Foreman, on Sec. 23-A, Langenfelder Section.

To The Pennsylvania Turnpike ! !

We take pride in our part in the extension of this great highway system — and are particularly proud of our men who supervised and constructed the various projects.

J. Richard Nissley

Landisville, Pa.

T-Beam built for Frank Mashuda Company, Section 21-A-1 at Carlisle, Penna.

T-Beam on Section 24-B built for C. W. Good, Inc.

6. Operators Oscar Mull and David Armold.

7. Charles Habecker, center, Foreman on C. J. Langenfelder section along with Marcus M., left, and Marcus E. Pless, right.

Arch built for C. W. Good, Inc., on Section 24-B.

On The . . .

PHILADELPHIA EXTENSION

Constructed by Williams Paving Company

Sections 22-C, 24-A, 21-B-2 and 22-A-1 — 14.396 Miles

We are proud to have worked on the Pennsylvania Turnpike — and take extreme pride in our part in this great achievement.

WILLIAMS PAVING COMPANY, INC.

1269 Princess Anne Road

NORFOLK, VIRGINIA

E. V. Williams, President-Treasurer

Ed. L. Williams, Vice President

Beaver River Bridge, Western Extension - - Pennsylvania Turnpike

By George S. Richardson, Consulting Engineer

THE LOCATION at which the Western Extension of the Turnpike will cross the Beaver River is a site of natural beauty. The valley is deep with wooded slopes and has been little disturbed by the hand of man except by the railroads which occupy the low and narrow terraces either side of the river. The Turnpike motorist will approach the valley either from east or west on high ground and cross the Beaver River Bridge on a roadway some 175′ above the river.

Preliminary studies for the bridge were made using photogrammetric plans made from an aerial survey. These plans were drawn to a small scale of 1″ = 200′ but showed complete and remarkably accurate topographic information. The preliminary layout for the bridge as determined using the aerial survey information had to be altered only slightly after ground survey data became available. This is another illustration of the great advance that has been made in aerial photography during recent years and its application to construction projects of this character.

The limiting conditions which controlled the layout of the bridge were line and grade as fixed primarily by general location requirements for the Turnpike through this area, navigation requirements as fixed by the War Department, and rights of way occupied by the Pittsburgh and Lake Erie Railroad Company on the west bank and the Pennsylvania Railroad Company on the east bank. As of today the Beaver River is not in fact navigable except for a very short distance above its mouth, but legally it is one of the navigable streams subject to the regulations of the Secretary of War, and may at some future date be a part of a proposed canal.

After consideration had been given to all of the controlling conditions, a general layout was adopted consisting of seven spans symmetrically arranged about the centerline of the main span over the river. The central unit is a three-span continuous deck truss with main span of about 409′ and end spans of 323′. At either end of the three-span unit there is one simple deck truss span of about 177′ and one beam span approximately 65′ in length. The total distance from east to west abutment is about 1,540′. The roadway will be the standard arrangement for all major structures on the Turnpike providing for two lanes of traffic in each direction with a total width of 56′ between curbs, including a 4′ divisor.

Many of the features of the construction of this bridge would be common to those of many projects of similar character. There are three items, however, of somewhat special interest.

On the slopes of the valley either side of the river, bed rock is either exposed or near the surface, and foundations for piers at these locations did not present any unusual problem. In the river bed, however, rock is more than 70′ below water level and part of the overburden is a glacial boulder terrace difficult to penetrate with any type of foundation. It was believed necessary to carry the foundations to bed rock, and in order to penetrate the boulder terraces with the least difficulty drilled-in caissons were adopted as the method for supporting the two river piers. Each of these caissons will consist of a 30″ diameter pipe shell driven to bed rock and having a core composed of a very heavy 14″ H beam encased in concrete poured within the shell. Before the core is placed the socket 7′ deep and of substantially the same diameter as the shell will be cut into the bed rock for each caisson. Each shell with its core is designed to carry a load of 1,000 tons, and only 15 shells are necessary for the support of each of the main piers. As of this date the shells for the river pier near the west bank have been successfully installed and part of the sockets formed. As soon as the cores have been completed a concrete seal 6′ thick will be poured within the sheet piling cofferdam and after this has set the cofferdam will be dewatered and the remainder of the pier constructed in the dry. The river piers will be almost 115′ high from the bottom of the concrete seal to top of the pier shafts, and from roadway level to bed rock on which the bridge is to be carried will be in the neighborhood of 250′. In order to provide additional lateral and longitudinal stability for this high structure some of the caisson shells are battered.

Only one special feature in connection with the superstructure design will be mentioned. In order to obtain the greatest economy in the construction of piers, floor system, and bracing, the trusses will be constructed 36′ center to center and the much wider roadway carried by a floor system built with floor beams on top of the trusses and extending to either side a sufficient distance to carry the roadway stringers, which in turn will be supported on top of the floor beams. With this arrangement floor beams and bracing are considerably lighter than they would be with the trusses located approximately on the curb lines, which is more generally the arrangement used, and a considerable saving is effected in the piers by reason of their shorter length. The arrangement is not new by any means, but only applicable under some conditions such as will prevail for this structure.

One of the problems adding greatly to the difficulties of constructing the Beaver River Bridge is satisfactory means of access. The first step required for getting the substructure work underway was the construction of access roads to various pier sites. Fortunately there is sufficient space adjacent to the Pittsburgh and Lake Erie Railroad a short distance below the bridge centerline to provide fairly adequate space for storage and plant requirements. The layout of the spans obviously suggests an erection procedure with rigs working from each end and closure at the center of the symmetrical

(Continued on Page 137)

Pennsylvania Turnpike Maintenance

By John W. Hadesty, Superintendent of Maintenance
Pennsylvania Turnpike System

FOR MAINTENANCE purposes, the Turnpike from Irwin to Carlisle, a distance of one hundred and sixty (160) miles, is divided into six (6) districts, namely; Donegal, Somerset, Kegg, Everett, Burnt Cabins and Newville. The districts vary in length, the shortest one being twenty-two (22) miles and the longest one, thirty-three (33) miles. A foreman is directly in charge of each district, with a personnel of twenty men, consisting of truck drivers and laborers. Three Maintenance Supervisors oversee the work in two adjacent districts, so that one supervisor is directly responsible for the section including Donegal and Somerset, the second supervisor has the Kegg and Everett districts, while the third supervisor is responsible for the Burnt Cabins and Newville districts. In addition to the regular maintenance work these supervisors handle the personnel and work at the tunnels, which are located in their districts. The above group is under the supervision of the Superintendent of Maintenance, who is assisted by a Superintendent of Equipment. The Superintendent of Equipment in addition to having charge of all equipment, also supervises the repairs to all buildings, maintenance of electrical equipment, and relamping. Mechanics, carpenters, painters, electricians, radio mechanics, plumbers and relamping crew are all under his supervision.

THE PHILADELPHIA EXTENSION of the Turnpike from Carlisle to King of Prussia is divided into four (4) districts. The Philadelphia Extension is approximately one hundred (100) miles in length, each district will cover about twenty-five (25) miles. The districts have not been named to date so they are referred to by number from West to East. Number One district starts at Carlisle and runs approximately twenty-five

(25) miles East and so on. The supervision and personnel of these four (4) districts is the same as described above, plus an Assistant Superintendent of Maintenance. The Superintendent of Equipment has an assistant on the Extension with personnel under his supervision similar to that previously described.

Maintenance work may be divided into two major groups; the first is the care of the concrete pavement and the adjacent areas. This is also true of the work required on the entering and departing lanes to the interchanges and service stations. The other division of this work consists of scaling cuts, maintaining ditches on top of cuts, care of spillways, cleaning and repairing ditches along and under the roadway and general clean up. Under the first heading, the concrete pavement is maintained and when necessary mudjacking is used to insure stabilization of the slab. Maintaining good drainage, keeping the shoulders well drained and all joints in the concrete pavement sealed is the chief function in maintenance.

Under the second division, cuts must be thoroughly scaled and during the season of the year when temperatures are changing from day to day, the scaling of cuts is an important item and prevents stones and rocks from sliding down and lodging on the pavement itself. The maintenance of ditches on the tops of slopes will help in stabilizing the slope in these cut areas. If the ditches are kept open and the water drained to either end of the cut, it will prevent many washouts along the slope of the cut. Spillways along the slopes of cuts should always be properly maintained as these spillways are usually connected with drainage ditches above the slopes. Drainage ditches and drains along and under the road must be thoroughly inspected and kept thoroughly cleaned out. The inlets for the underground drains must be cleaned periodically to prevent material from getting into and blocking the drain pipes themselves. Mowing is one of the last items under this division but is very necessary for good appearance since a well mowed medial strip and portion of the right-of-way on either side of the road adds considerably to its appearance. General clean-up is necessary, namely gathering up newspapers, maps, drinking cups and general policing at regular intervals and particulalry after holidays.

Snow removal is usually handled by trucks equipped with front plows passing the snow from one plow to another. After the snow has started to accumulate on the road bed these trucks, travel not less than five hundred feet apart and in angled convoy with the first truck plowing from the center of the median strip and the trucks following staggered so that the last plow, the largest one, and on the outside, pushes the snow over the guard rail or beyond the shoulder.

The Turnpike's Part In The Renaissance of Highway Commerce

By Edward Gogolin, General Manager
Pennsylvania Motor Truck Association

LONG before early businessmen in Pennsylvania ever thought of canals or railroads, trade and commerce between the interior of the state and the great port of Philadelphia flourished through over-the-road transportation. Conestoga wagons, traditionally painted red and blue and carrying between three and four tons, carried the goods over rutted trails that would be considered mere pathways today.

Enterprising businessmen, recognizing the importance of trade to the prosperity of their industries and communities, banded together to build turnpikes that rescued these early commercial freighters from the mud. Many turnpike companies were chartered by the Legislature of Pennsylvania in the early 1800's. Three of these closely paralleled the eastern extension of the Turnpike. Today they are known as the Lincoln Highway (U. S. Route 30), the 28th Division Memorial Highway (U. S. Route 322) and the Benjamin Franklin Highway (U. S. Route 422).

These arteries of commerce declined in importance with the development of the canal and railroad. Hauling with these big-wheeled freight wagons was slow and expensive. The trip was rough and much cargo was damaged enroute. The canals, although not much faster, did eliminate a large part of the cargo damage. Later the railroads, offering a faster service, put the canals out of business. But even at the height of canal and railway expansion, roads continued to be of vital importance. The railroads only served those points where their tracks ran. Local distribution and several thousand outlying communities were still dependent on early trucks and wagons. Everything then, as it does now, sooner or later moved by highway transport.

With the advent of the internal combustion engine and the resultant development of better vehicles, adequate roads became a pressing need. Research into the use of asphalt and concrete and many other materials produced the prototype of the modern hard-topped road. Highway commerce again became of prime importance.

Today we are experiencing a 20th century renaissance in highway commerce. Strains have become apparent in this significant re-emergence of over-the-road transportation. We are faced with an ever increasing volume of traffic and we have a growing inadequacy of the highway system.

Penna. Turnpike Commission Photo.

The Turnpike is a highly strategic link in the line of supply for our soldiers, sailors, marines and airmen, no matter where they are. Trucks will carry over the Turnpike the materials that mean success and victory for our armed forces. Photo shows Turnpike curve at Fort Littleton.

Pennsylvania, with its 41,000 miles of state highway — more than the total of 10 other industrial northeastern states — is among the leaders in trying to build and maintain a road system capable of serving the traffic needs of this highway age. The problem in Pennsylvania is typical of all the states. Here we are trying to accommodate 2,809,000 motor vehicles today on substantially the same road mileage as 40 years ago, when there were only 33,346 motor vehicles registered.

Outstanding in solving this problem of inadequate highways is the now world famous Pennsylvania Turnpike. Begun in the middle of the depression of the 1930's with a 160 mile stretch of superhighway between Pittsburgh and Harrisburg, the 100 mile eastern extension to Philadelphia opening today and the 67 mile western extension to Ohio will make this highway, in the words of Governor James H. Duff, "The most wonderful highway in the world."

This importance of adequate road facilities to the prosperity and stability of Pennsylvania's business was well expressed by Governor Duff in a recent speech at Dillsburg when he said that Dillsburg

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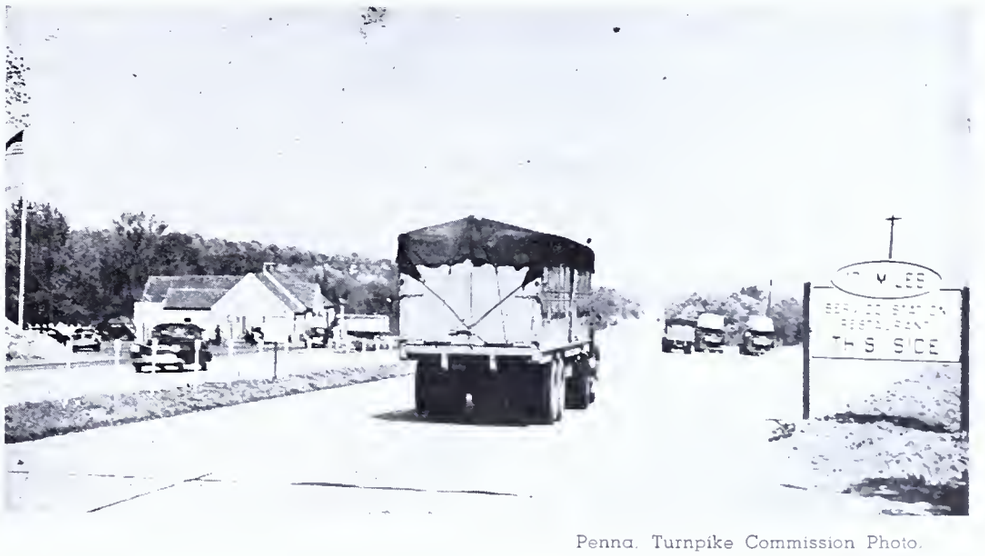


Penna. Turnpike Commission Photo.

Although trucks have averaged only one-fifth of all total vehicular traffic, they have paid over 50 percent of the total revenue collected since the Turnpike opened. Photo shows east view from Blue Mountain Interchange.

Installing dowel unit load transfer joint on sub-grade of Philadelphia extension of Pennsylvania Turnpike.

Laying hinged bar mat on Philadelphia extension on the Pennsylvania Turnpike.

Steel and The Pennsylvania Turnpike

By C. A. Willson, Research Engineer
American Iron and Steel Institute

TEN YEARS ago, on October 1, 1940, the original Pennsylvania Turnpike was dedicated. With the opening of the new eastern extension just a decade later another step has been taken in the realization of a century old dream of a thoroughfare which would span the Commonwealth from east to west, tieing together the great cities of the seaboard and the commercial and agricultural centers along the Ohio river and beyond.

With the opening of the $87,000,000 100-mile Philadelphia extension there is now ready for the motorist a 260-mile-long steel and concrete thoroughfare linking Philadelphia and Pittsburgh. The western extension, expected to be completed in 1952 at a cost of $77,500,000, will add another 67 miles to the highway and it will then be possible for the motorist to drive 327 miles non-stop at speeds up to 70 miles an hour from Philadelphia to Gateway, on the Ohio state line.

The world's first all-weather limited access toll highway, the original Turnpike spans some of Pennsylvania's most rugged territory, crossing the Appalachian chain of mountains on grades not exceeding three per cent and passing through seven tunnels. Its engineering characteristics have had a significant influence on highway design and construction.

The use of steel as an integral part of the physical structure of the Turnpike has been carried into the design of the extensions. In the 100-mile-long eastern extension there are laid nearly 3,000,000 square yards of steel mesh or hinged bar mat approximating close to 11,000 tons. Nearly 10,500 tons of steel reinforcing bars strengthen concrete structures. Load transfer dowel units installed in the pavement approximate 2,433 tons. Close to 135 tons of hook bolt dowels (150,000 units) and 150 tons of deformed tie bars (about 80,000 units) also strengthen the pavement.

Thirty-six tons of sheet piling and 1,779 tons of H piling were driven. In overpass structures and stream bridge there are approximately 16,000 tons of structural shapes. Approximately 210,600 lineal feet of storm sewers, pipe and pipe culverts are laid in the extension.

To guard the right-of-way from unauthorized access a total of 700 tons of galvanized fencing, about 1,056,000 lineal feet, was erected, using 300 tons of galvanized steel posts.

Stretching along the 100 miles of highway are 355,000 lineal feet, approximately 1,700 tons, of safety beam guard rail erected on 6x4-inch steel posts well driven in the earth to provide maximum security to the highway users. In addition, grade separations are protected on all approaches by more than 200 tons of cable guard also erected on steel posts

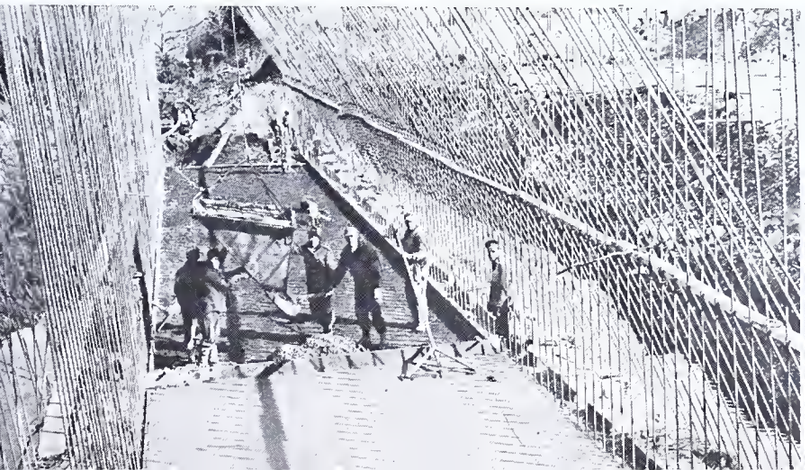
To be taken into account, also, in enumerating the steel involved in the Turnpike extension must be the unmeasured quantities of nuts and bolts used, of nails and spikes driven, of tie wire consumed, of wire rope, rock drills, digging bars, shovels, axes, picks and dozens of other incidental articles necessary to the mechanics of construction.

Nor should the stainless steel toll houses and canopies be omitted. There are eight of these on the eastern extension and six more will be erected on the western extension. The ten toll houses on the original Turnpike are of enameled steel, not stainless.

Perhaps the most interesting use made of steel in the Turnpike is the load transfer dowel unit installed at abutting ends of pavement slabs. Three makes of these units were supplied, their primary function being the same in all cases, — to hold the slab ends in alignment under the moving traffic load and to permit un-

(*Continued on Page 86*)

Left: Network of steel reinforcing bars in concrete arch culvert carrying MarshRun beneath the Pennsylvania Turnpike near New Cumberland. A 60-foot fill covers the culvert. Right: Paving crew at work on Philadelphia extensionof the Pennsylvania Turnpike.



Steel and The Pennsylvania Turnpike

(*Continued from Page 85*)

inhibited movement of the slabs during changes of atmospheric conditions.

Pavement joints are of two kinds, contraction and expansion. In the Turnpike extension general practice called for approximately 18 of the former to one of the latter in every 900 feet of pavement, with additional expansion joints wherever the slab meets structures, such as bridges.

The dowels are made of one-inch round rods 24 inches long, mechanically supported on 12 inch centers in the center of the finished slab. The contraction joints are formed by use of steel plate approximately 4½" wide; in expansion joints the filler is of fibrous compressionable material.

Dowel bars are secured at alternate ends to the supporting steel, their free ends being provided with slip caps and coated with bitumen to prevent adhesion by the concrete. Thus they may move in longitudinal horizontal plane as the concrete expands or contracts.

In the Turnpike extension there were several instances where the pavement slab was put down in full 24-foot width, in which case the longitudinal joint, ordinarily present when two 12-foot slabs are laid, was effected by making a longitudinal cut about three inches deep. Transverse tie bars of 5/8-inch deformed steel each four feet long placed in the concrete on five foot centers.

Where 12-foot paving slabs were laid adjoining each other, a longitudinal keyway was provided by installing a removable metal form. Hook bolt dowels were installed on five-foot centers to prevent the two slabs from parting. The tie bars are of 5/8-inch round steel stock and are made in two parts, one end of each threaded. One part, provided with a female thread, is attached to the keyway form and remains in the concrete after the form is removed. The second part is then screwed into the first in preparation for pouring the second slab.

Swinging fabricated steel bridge truss into place on piers at Swatara Creek crossing along the Philadelphia extension of the Pennsylvania Turnpike.

The motorist speeding over the smooth surface of the highway probably has little notion that he is riding over a mesh of steel bars. Nevertheless, were it not for these bars buried in every square foot of the highway pavement, the fine road he travels would soon deteriorate. The steel mesh helps to absorb longitudinal stresses set up by temperature changes and the moving traffic. Without this mesh it would not be practical or economical to construct a concrete pavement sufficiently strong to withstand the constant battering.

Crossing the Susquehanna river between the York county shore and the towns of Steelton and Highspire on the new mile-long high level bridge the traveler rides on a superstructure supported by 45 land and river piers made of reinforced concrete. The four-lane bridge deck contains 750 tons of steel reinforcing bars, 6,225 tons of structural steel and 8,600 cubic yards of concrete. It also contains 170,000 pounds of special silicon steel in saddles, bearing plates, etc. The railings are made up of 360 feet of steel plate and 8,700 feet of steel channel sections.

There are on the eastern extension of the Turnpike 123 bridges of varying dimensions spanning streams, grade crossings, etc. in all of which structural steel is employed. In addition, there are 94 reinforced concrete drainage structures, such as arch and box culverts.

Restaurant buildings along the extension are of stone and steel construction, and steel is used in maintenance and other Turnpike Commission buildings.

For all practical purposes the extension is a duplicate of the original Turnpike. It occupies a 200-foot right-of-way, which widens at interchanges, service stations, etc. There are two 24-foot traffic lanes separated by a 10-foot medial strip and with a 10-foot berm alongside each.

Grades on the extension do not exceed 2 per cent and curves 4°. On the old Turnpike the grades are up to 3 per cent and curves up to 6°. All curves are designed with super-elevation for high speed driving, the top limit being 70 miles an hour for passenger cars. Great care has

(*Continued on Page 149*)

Material Procurement and Control

By G. A. Rahn, Materials Engineer
Pennsylvania Turnpike Commission

IN THE TEN years which have passed since the opening of the original section of the Pennsylvania Turnpike, highway engineering has progressed and it is the goal of the Pennsylvania Turnpike Commission now, as it was then, to include all proven developments in design, materials and construction, in order to obtain the most durable and safest highway possible.

Demand for materials for an undertaking of this magnitude cannot be thrown on the market abruptly and expect prompt delivery. Rather, it is imperative that the market be informed as far in advance as possible relative to qualities and quantities required, so that production can be planned thereby assuring the availability of materials when needed. It is also necessary, from the standpoint of both time and basic economics, to conduct the material control in such a manner that will react to the mutual advantage of the Contractor, the Producer and the Consumer.

With the approval of the design, the development of specifications, the designation of contract sections and the adoption of the construction schedule by the Commission, it became possible to estimate the type and quantities of material required. The analyses of the requirements of the major items such as structural steel, reinforcing steel, cement, fine aggregates and coarse aggregates were made section by section and month by month. These figures were shown in graphical form and integrated answered the questions of "How much is needed"; "Where is it needed" and "When is it to be delivered?" It also indicated the monthly and peak demands. This information in detailed graphical form was then presented to industry as an approximation of material requirements. It is interesting to learn from several of the industries, at the time of this writing, that the indicated quantities held remarkably close throughout the construction period.

Conformance with standard highway practice parallelling that of the Pennsylvania Department of Highways where possible, also tended to stabilize procedure. Several design features caused a deviation to some extent but this was held to a minimum, and it was possible to fit them into the general over-all picture without too great confusion.

One of these, special subgrade, was an interesting case in point. The design called for a stable, drainable material which would increase the subgrade bearing value and also tend toward the elimination of pumping joints. In the development of this specification the latest available engineering data were studied and a representative group of Contractors who had had experience in this type of construction were consulted. Drainability is premised on the U. S. Army Engineers criteria for special subgrade for air fields. The Army Engineers study was conducted on the principal army air fields of the country in which it was determined that a material having a degree of drainage of fifty (50) percent in ten (10) days proved satisfactory. The correction for pumping is based on a nation-wide survey made under the supervision of the Highway Research Board to determine the cause and correction of the pumping of concrete pavement joints in which it was found that pavements laid on subgrades having fifty-five (55) percent of their particles retained on a No. 270 mesh sieve (270 openings per linear inch) and a Plasticity Index (adhesive or cementing factor) of less than seven (7) did not develop pumping.

Realizing that economics demanded the widest use of local materials and with the above information as a base, a series of four gradations were adopted ranging from coarse graded to fine graded, all of which were safely within the limits set for suitable drainability and sufficiently coarse to resist pumping.

The design also called for firm stabilized shoulders which would provide safe transition and passage way for vehicles travelling at high speeds if forced to leave the regular traffic lanes. To meet this requirement accepted standard practice for material and construction for the mechanically stabilized type was adopted, which again provided for the use of local natural or manufactured material with a specified top size of one (1) inch for aggregates, in order to provide for ease of maintenance.

From its superiority, proven over a ten year period in many and varied types of construction, air-entrained concrete was specified for use in all pavement, bridge and culvert construction. The type of air-entraining portland cement used was that in which the air-entraining agent was interground with the cement at the mill. Excellent results were obtained in both placement and control of the concrete.

As noted before conformance with present standard highway practice aided greatly in the material procurement and control setup. In the testing field certain facilities of the Laboratory of the Pennsylvania Department of Highways were made available to the Commission by the Highway Department, thereby enabling the inspection and testing of a considerable amount of material such as cement, pipe, reinforcing steel and bulk bituminous material to be handled on a very efficient basis. This was doubly valuable as in numerous instances the Turnpike and Highway Department Specifications were identical, thereby enabling the producer to ship from common, inspected and tested stock. In conjunction with this organization the Pittsburgh Testing Laboratory and the E. L. Conwell Laboratory were retained for inspection and testing in specialized fields.

Field control of materials centered in the several engineering districts. A District Materials Engineer reporting directly to the Materials Division, directed the inspection, sampling and field testing of materials; concrete and bituminous mix design; concrete batch plant, bituminous mix plant, special subgrade and stabilized shoulder control.

The concrete mix design was premised on the absolute volume method. Concrete quality was controlled through the medium of field flexure tests on concrete beams. Entrained air was determined by means of the Washington Air Meter just recently developed by Engineers of the Washington State Highway Department, this instrument was accurate and gave efficient service, it is especially desirous in winter work as no water is involved in the test.

Again with the time element in mind facilities for the control of special sub

(Continued on Page 126)

The Financial Success of the Pennsylvania Turnpike

By W. J. Roberts, Comptroller, Pennsylvania Turnpike Commission

THE PENNSYLVANIA Turnpike is unique and new in many respects. Not only is it acclaimed for its design and construction but for its method of financing as well. In it, experts throughout the country can foresee the acquisition of similar highways without the neeessity of further and added eosts to the general tax paying public—for the Pennsylvania Turnpike was built without one cent of state tax monies.

The explanation is found in the fact that this great highway system was built with monies seeured from the sale of bonds payable solely from the revenues derived from its use. The bonds so issued are not, directly or indirectly, an obligation of the Commonwealth, either as to payment of interest or principal. Consequently, no tax monies are involved.

Having no previous experience of a similar undertaking to guide it, the Turnpike Commission became a "pioneer" in this type of road building. Engineers were engaged to estimate the cost of construetion and the potential traffie and earnings. These studies revealed the praetibility of the projeet. However, this constituted only one phase of the vital work. Following the completion of these reports it was neeessary to seeure an interest in the bond isssue which would provide the finances for construction. It was impossible to interest either publie or private eapital in the purehase of its bonds because brokers were unaeeustomed to this type of financing and were reluctant to commit themselves for such a large amount of bonds to finance something new and untried in the field of investment.

The sale of its bonds was made possible for the Commission through the commitment by the Reconstruction Finance Corporation to purchase the entire issue of bonds, as funds were needed, which totaled $40,800,000; all of which were resold to a syndicate of private banking interests simultaneously upon the receipt of each block thereof. Further aid was received through a grant received from the Public Works Administration which totaled $29,250,000. Thus the construction of the Turnpike was made possible.

The success of the Turnpike was apparent from its opening to traffie October 1, 1940. The traffic engineers had estimated that for the first full year of operation 1,300,000 vehicles would use

the Turnpike with earnings of $2,670,000. The first year totals diselose that the facility was used by 2,473,817 vehicles and the revenue $2,950,212.78. This year also produced a record for passenger ear traffie using the Turnpike in a single day when on Oetober 13th, 1940, 28,104 passenger ears used the roadway. The actual returns for both vehieles and revenue exceeded the original estimates.

As Deeember 7th, 1941, proved to be a date of the utmost significance to our country, interrupting our normal way of living, it too, had great effect upon the history of the Turnpike. The early suecess of the Turnpike enjoyed in the initial 14 months of its existence was disturbed. The Commission sustained losses of revenues throughout 1942, 1943 and 1944 during the period of restrictions to traffic so necessary for the full and successful proseeution of the war against the enemy. The full effect of this restricted period can be seen when one realizes that during the 42 months from December 1, 1941 to May 31, 1945, the average daily traffic using the Turnpike was 3,080 vehieles. Whereas, the original estimate ealled for a daily average of 4,270 vehicles in 1942, 4,920 in 1943, and 5,410 in 1944. These were dark days in the history of the Turnpike and called for the exereise of the closest scrutiny in the handling of the affairs and the making of expenditures. At no time, however, during this long period was the income insuffieient to maintain and operate the highway in perfect condition, but the chief concern was the meeting of interest requirements on the outstanding issue of bonds amounting to $1,586,250 per year or about $4,300 per day. It was realized very early in consideration of ways and means of meeting this obligation that some additional legislation was necessary beyond that provided in the original Turnpike Act. The General Assembly aeted very promptly and favorably in providing this required legislation whieh became Act No. 381 upon approval by the Governor, May 24, 1945, under whieh the Commission was authorized to issue revenue bonds for war emergeney financing of interest and sinking fund requirements, as well as refunding any bonds issued and then outstanding.

With the lifting of restrictions and return of traffie to the highways following eessation of hostilities on both the European and Paeific Fronts, the earnings of the facility immediately rose to former standards and eliminated the neeessity of issuance of any bonds for emergeney financing. Some conception of the restoration of traffic following the end of the war may be gathered by the faet that during the period from June 1, 1945 to May 31, 1946 the daily average traffic increased to 5,300 vehieles a day.

With the need for emergeney financing alleviated and with the restoration of normal travel, the Commission direeted its attention toward the possibilities of obtaining, if possible, a lowered rate of interest through refunding the outstanding bonds and thus be in a position to utilize increasing earnings to the best and fullest extent. Sustained and exhaustive study was made of this matter for many months before final determination by the Commission was made on November 26, 1946, to produce with the refunding program. This program was carried out when on December 1, 1946, the Turnpike Commission sold $46,000,000 bonds for refunding the original projeet. This refunding program covered the $42,300,000 principal amount on the original bonds and in addition covered the redemption premium of 4% applicable on August 1, 1947 and included the interest on the 3 3/4 bonds payable February 1st and August 1st, 1947, together with a refunding balance of the $1,500,000 previously authorized but not issued.

(Continued on Page 126)

Take a look at tomorrow's highway

There's a great new era ahead in road construction. And the Pennsylvania Turnpike, now extending eastward to the outskirts of Philadelphia, westward toward Ohio, is *your* long look into the future.

This modern "thru-way", a pioneer triumph of engineering for transportation safety, speed, comfort and convenience, is the nucleus of a vast super-highway transportation system that one day may link every section of the country.

We are proud of the part our blasting materials and our explosives engineers have played in helping to speed the construction of the new Eastern Extension of the Turnpike.

To all of you who have helped to bring this great project to a successful completion, we extend our hearty congratulations.

AMERICAN *Cyanamid* COMPANY

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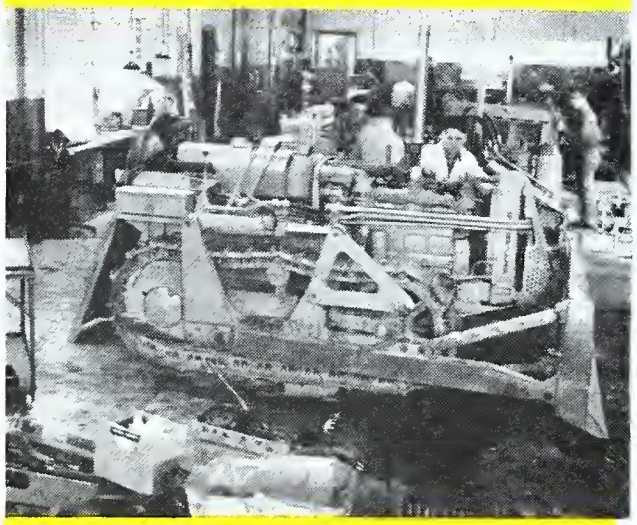
America's finest — the Pennsylvania Turnpike — rolls on. "Caterpillar" D8 Tractors and No. 80 Scrapers work lowering costs, on a section of the eastern extension.

The modern sales and service center of Giles and Ransome is equipment headquarters for contractors working on the new sections of the Turnpike.



The service experts of Giles and Ransome back the big-work capacity of equipment working on the road — keep them on the job!

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The Turnpike contractors prefer "Caterpillar" Diesel Power — for dependability, for low operating costs, for long life, **for the service of Giles and Ransome that stands behind it!**

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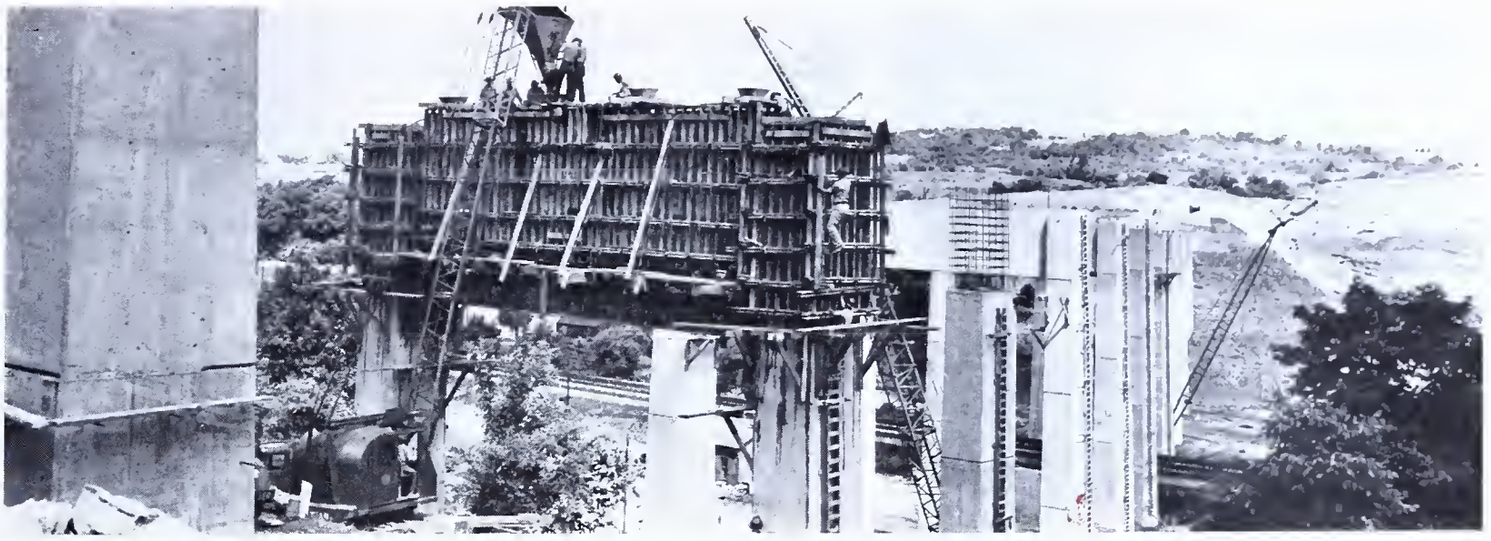

Turnpike and Highway Construction In Western Pennsylvania

By Thurman C. Tejan, Executive Secretary
Constructors Association of Western Pennsylvania

MOTORISTS travelling west on the existing Pennsylvania Turnpike will no longer be forced to leave that high-speed artery at Irwin, Pennsylvania, after October 1, 1950, for every effort is being made to have the eastern most sections of the western extension completed by that time.

Contracts for the western extension of the Pennsylvania Turnpike extending from Irwin to Petersburg, on the Ohio line, have all been let at a cost totalling almost $50,000,000. The first five sections which were let embrace a distance of approximately 12 miles. They are scheduled for completion to coincide with that of the eastern section. This work is now progressing ahead of schedule and is being performed by the Latrobe Road Construction Company, Latrobe, Pennsylvania; the Ferguson and Edmondson Company, Pittsburgh; the D. W. Winkelman Company, Syracuse, N. Y.; the Pavia Company, Verona, Pa.; and the Ralph Myers Contracting Corporation, Salem, Indiana, in that order, from east to west. All are members of the Constructors Association of Western Pennsylvania as are all the prime contractors on the western end with one exception. The new Pittsburgh interchange is located at the junction of the new Turnpike extension and Route 22, the William Penn Highway. From this interchange, Pittsburgh traffic will be carried on a reconstructed Route 22 for a distance of approximately six miles to the new Penn-Lincoln Parkway in Churchhill Borough. When completed, the Penn-Lincoln Parkway will provide through traffic accommodations for motorists wishing to skirt the city itself for points west. Millions of dollars are going into such projects for the greatest highway improvement program in the history of Western Pennsylvania. Although still in the planning stage, a crosstown boulevard is contemplated for the city which will alleviate much of the downtown traffic congestion. In conjunction with this work, highway work has been let which will make access to the Turnpike more convenient for those residents in the vicinity of Routes 19, 8, 422, 31, 119, 22, 30, and 56, either through the improvement of existing high-

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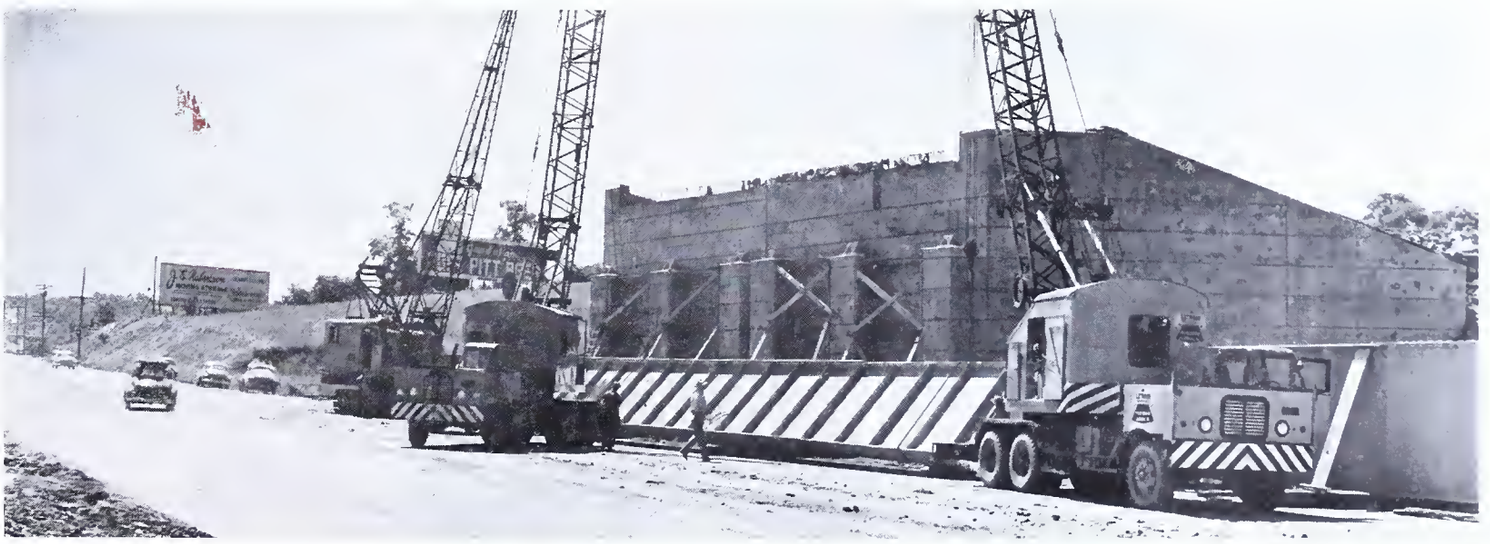

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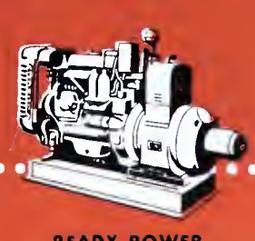

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The Powerful

"Up an' at 'em!" This "Caterpillar" Diesel D8 and its 'dazer certainly makes itself understaad wherever it sticks in its nase inta clearing virgin land far the Turnpike Western Extensian. Owned and aperated by D. W. Winkelman Ca., Inc.

Loads it seems are never toa big for a "Caterpillar" Diesel DW10 where the territary is at all navigable. This is ane af three similar autfits with "Caterpillar" W10 Wagans owned and operated by Ruth Canstructian Co. af Scattdale, Pa., an the Western Extension.

Levelling a top-sail stack pile for the Turnpike Western Extension with o "Caterpillar" Diesel D8 Troctor ond Bulldozer. This port of the work goes rapidly under the powerful Dozer, which is owned ond operated by L. G. De Felice & Son, Inc.

Earth Moving "Caterpillar" Fleets Helping Build the Great Turnpike Extensions

The world's greatest highway is being made greater —and "Caterpillar" of necessity is in heavy on the job.

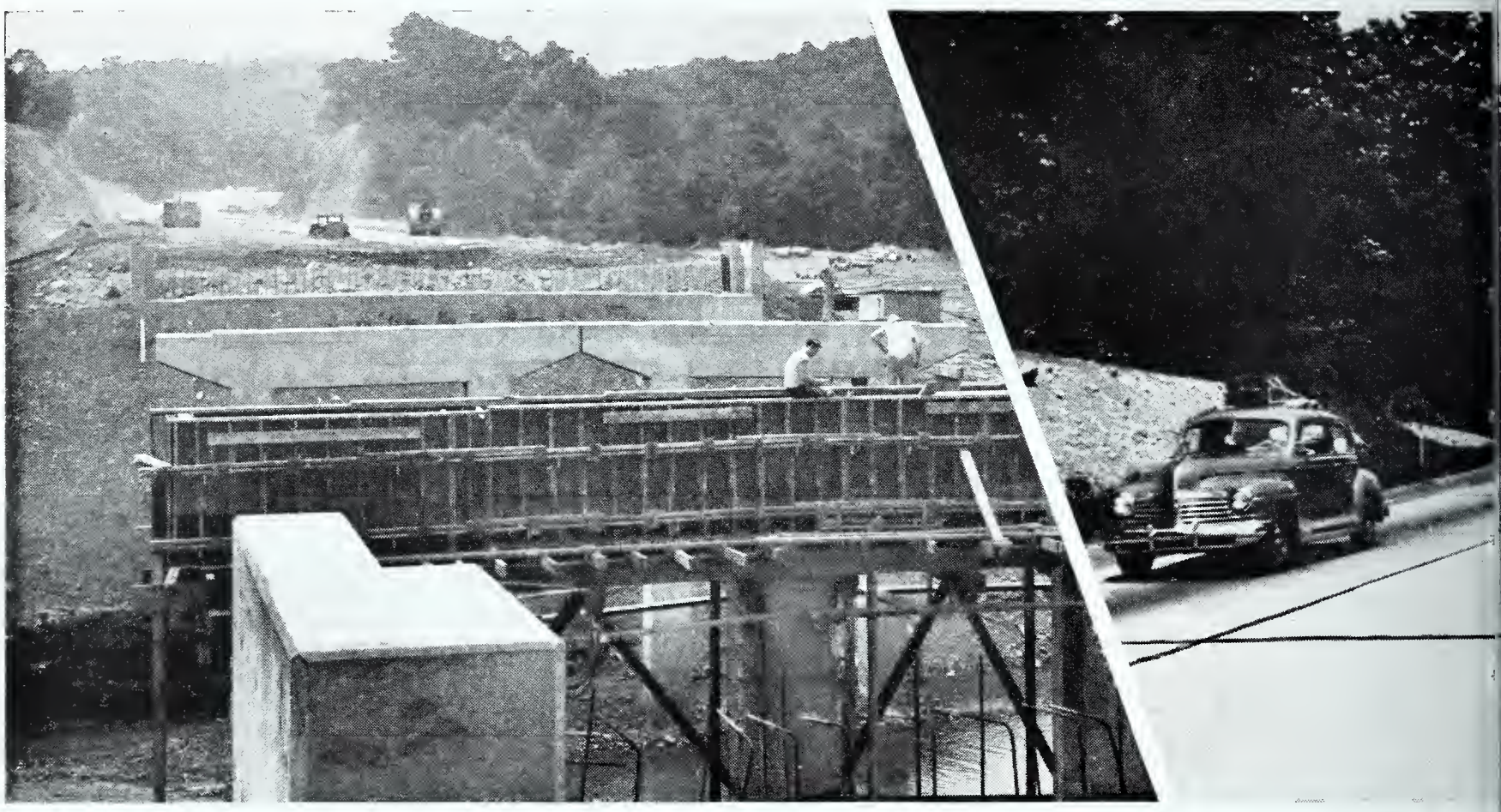
Now under rapid construction, when completed there will be a master roadway to serve generations of Pennsylvanians and thousands of travelers from all corners of the land. More, the Pennsylvania Turnpike is already the chosen economical high-speed travelway of the hundreds of massive truck-freighters between East and West.

The construction of the extensions is a titanic earth-moving job. It is the kind where ever-dependable, powerful "Caterpillar" units serve best.

The "Caterpillar" Diesels shown here were among those sold and now serviced by Beckwith Machinery Company. "Caterpillar" and Beckwith together are the top assurance of top profit and continuous operation on earthmoving jobs — gigantic jobs or a single small basement job.

Upstoirs ond down, these two outfits ore effectively helping push through the Eostern Turnpike Extension job. Above is o "Coterpillor" Diesel D8 with Hyster Back-Hoe; at bottom is the fomilior Diesel D8 with its "Coterpillor" Bulldozer, Horrison Construction Compony outfits.

The World's Greatest Highway . . . . PENNSYLVANIA



Ohio line to Irwin 67 MILES

Irwin to Mid

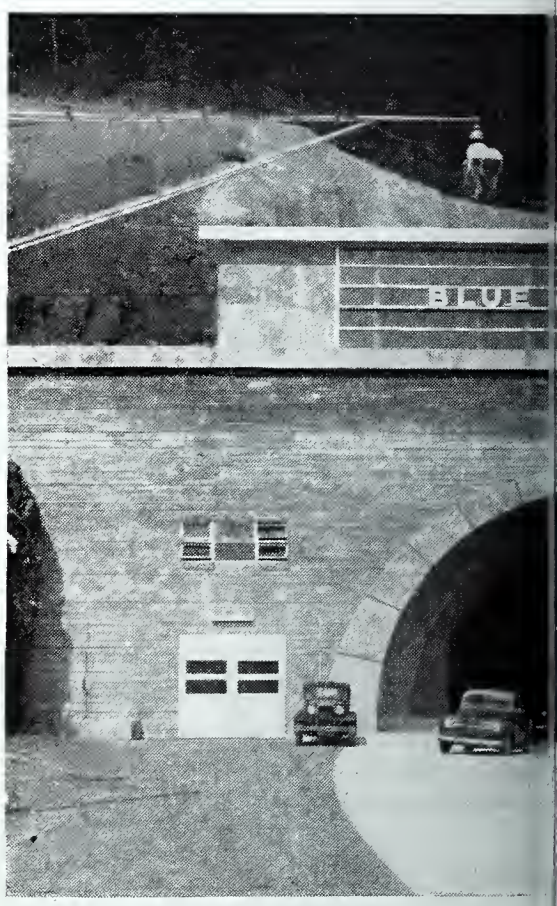
Nowhere is service value to the highway user more closely evaluated than in planning a facility such as the Pennsylvania Turnpike System.

Such a facility must be built to the most advanced standards of modern highway engineering. It must provide many extras in comfort, speed, safety . . . it must be a facility that travelers will willingly pay to use.

At the same time, it must be so designed and constructed that these extras will retain their value for many years regardless of traffic increases and normal developments in highway construction.

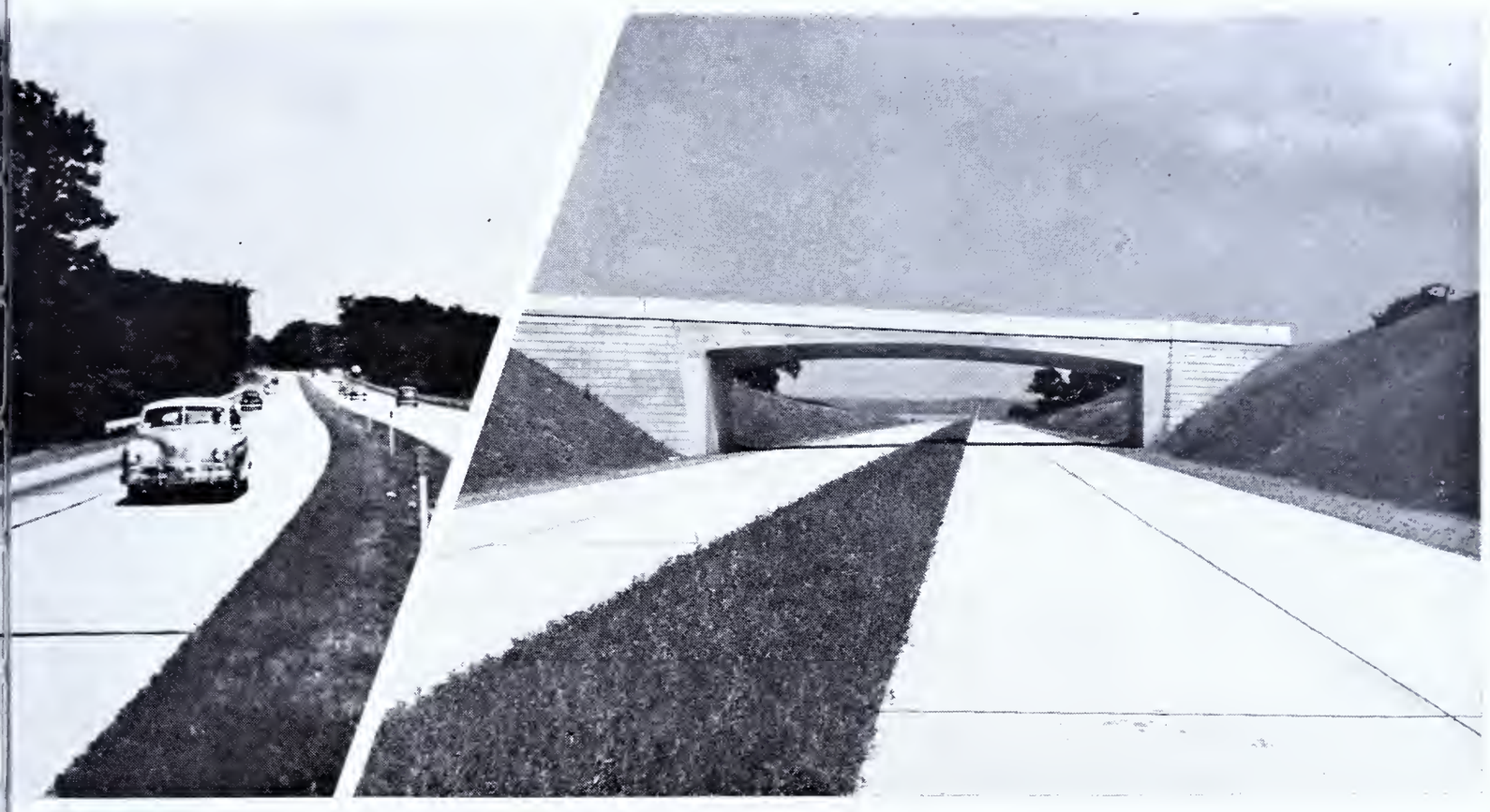
It was natural that the Pennsylvania Turnpike Commission turned to concrete for paving this 327-mile expressway from Ohio to the great Philadelphia area.

Performance of the 10-year-old original Turnpike proves again that concrete is the low-annual-cost pavement, particularly for heavy duty roads. Improved construction techniques, use of air-entraining portland cement, special subgrade treatments



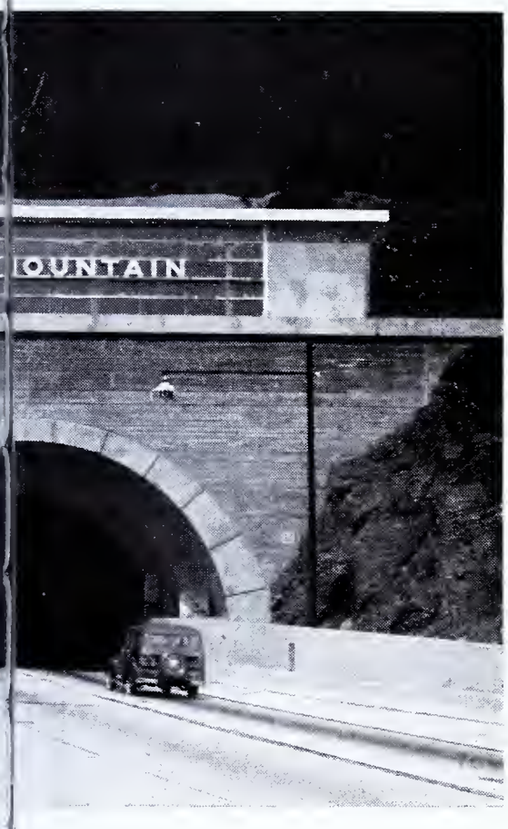
One of seven tunnels that save m existing mountain routes. Longes shortest 3,532 feet. Total tunnel ler

TURNPIKE SYSTEM .... CONCRETE *all the way!*



lsex 160 MILES

Middlesex to King of Prussia 100 MILES



rists 9,000 feet upward climb over unnel is 6,782 feet in length; the h is 6.7 miles.

and drainage precautions on the two extensions will provide even greater economies over the years.

It is significant, too, that concrete is the overwhelming choice for the rapidly-growing mileage of all divided highways coast-to-coast . . .

- Concrete is inherently safer. It is skid-resistant, wet or dry; affords high visibility at night.
- Concrete is satisfying to drive on. Its smooth-riding, even surface improves car control, reduces driver fatigue.
- Concrete is economical. Concrete almost invariably costs less to build than other pavements of equal load carrying capacity . . . It costs much less to maintain . . . It lasts longer . . . It reduces vehicle operating costs.

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- 24.5 cu. yd. heaped capacity; 19.2 cu. yd. struck capacity.
- Open bowl design.
- Forced, controlled ejection.
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- Extra strength throughout — plenty of beef where needed.
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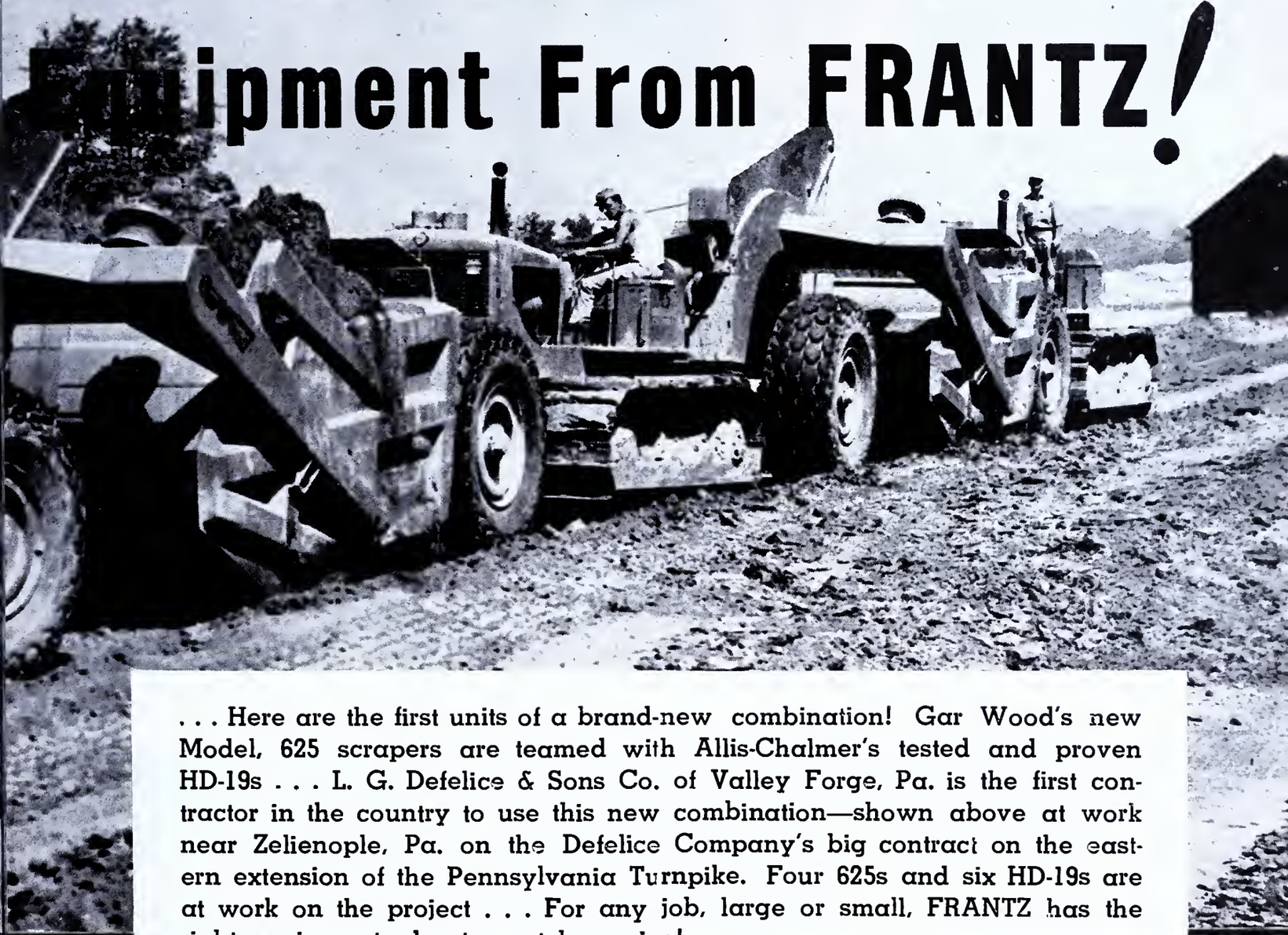

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PMF Officials Commend Accomplishments of Pennsylvania Turnpike

President A. J. Sordoni Adduces Traffic Volume as Justification of Extension. Secretary-Manager Cites Turnpike as Greatest Tourist Attraction in State

A. J. Sordoni

ALREADY tried and proven as one of the finest engineering developments in the world, the Pennsylvania Turnpike will become an even greater masterpiece of highway engineering with the opening of the eastern extension to a point near Philadelphia.

The Turnpike as it existed between Irwin and Middlesex was a super-highway second to none; there can be no doubt but that the extension will further increase the value and importance of what was originally referred to as a "dream road." Germany bragged about its world-famous Audubon Highway, but Pennsylvanians can boast about a highway that is far superior to that or any other road in the world.

It is interesting to note that ten years ago on the opening of the original Pennsylvania Turnpike, my worthy successor of the Pennsylvania Motor Federation, the late Judge Howard W. Hughes, raised the question: "Will this $70,000,000 project, which is unlike other existing super toll roads through congested areas, pay for itself during the next decade or two?" With the eastern extension now being added, and the westward extension to the Ohio State Line to be opened in the near future, the answer today should be obvious.

Aside from the fact that the Pennsylvania Turnpike is one of the greatest tourist objectives in the Commonwealth, the super-highway also serves as a speedy and modern type artery of travel, accommodating both high-speed automobile traffic and heavy commercial truck traffic. Not only does it share the enthusiasm of the average motorist under normal peacetime conditions, but it is of supreme importance as a military artery in connection with national defense.

While the Pennsylvania Turnpike originally started out in some degree as a Federal project to relieve unemployment, it turned out to be one of the finest engineering developments of our time. The heavy volume of traffic that has made use of the Pennsylvania Turnpike, especially since the end of the war, certainly justifies its extension as one of the best express highways to be found.

THERE can be little question that the original Pennsylvania Turnpike served as a magnet to attract tourists of the Nation to our great Commonwealth, and the eastward extension will only serve to amplify the express highway as a travel objective.

Frequently a lecturer of my acquaintance has pointed out that no matter in what section of the United States he speaks, or on what subjects, questions always turn to the Pennsylvania Turnpike. The super-highway fires the imagination of folks from coast to coast as no other attraction in Pennsylvania.

Travel has been described as the fastest growing business in Pennsylvania today. The State and business both benefit by the money spent by tourists.

In 1939, Pennsylvania received $324,000,000 from the vacation and travel business. Last year that figure had grown to $600,000,000, and there is every indication this figure will be eclipsed in 1950.

More people will be traveling to and in Pennsylvania this year than ever before. One reason for that increase, aside from the fact that more people are traveling this year than at any time in our history, is that many motorists have a desire to see and ride over our Pennsylvania Turnpike.

Even more important than its role as a tourist attraction is the link the express highway will furnish in the National System of Interstate Highways. Utmost importance attaches itself to such a highway system spanning our country; it is important, not only to interstate travel and commerce, but important to the national defense. With the Pennsylvania Turnpike soon to span the Commonwealth, it takes no stretch of the imagination to envision a National System of Interstate Highways that will make it possible for motorists to drive from the Atlantic to the Pacific across our nation on the same highway in less time than our forebears could have ever forseen.

R. B. Maxwell

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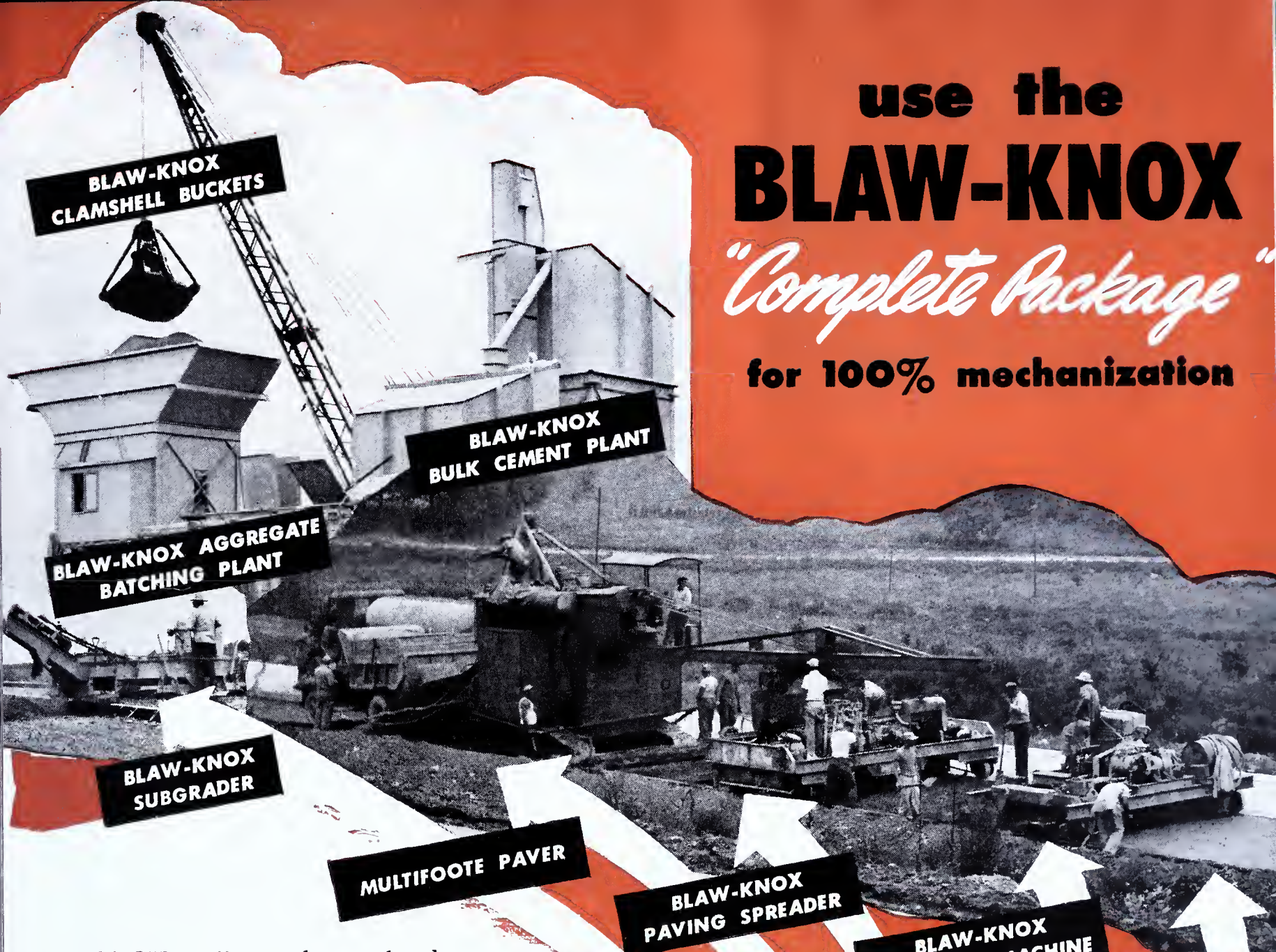

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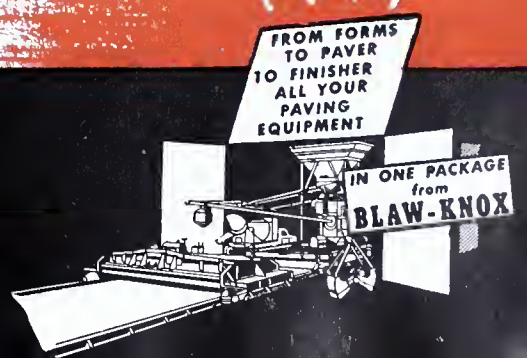

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▲ Drafting Room

THE "GRAND-DADDY" OF SU

This is the pictorial story of the administrative and engineering mechanics involved in the construction and operation of the Pennsylvania Turnpike System. The pictures depict the various operations preliminary to actual construction.

These photographs, taken at the Central Of-

Consulting Engineer ▶

▲ Photostat Department

▲ Construction Statistical Department

◀ Bridge Department

The Turnpike wending its way through the countryside ▶

◀ Fare Revenue Department

ER-HIGHWAYS FANS OUT

fice of the Turnpike Commission in Harrisburg, show the various divisions—bridge department, accounting, engineering, drafting, right-of-way, revenue, transportation, etc.

Every department is an intricate part in the efficient and successful operation of this great superhighway. The Commissioners and the personnel are to be commended for their proficient management.

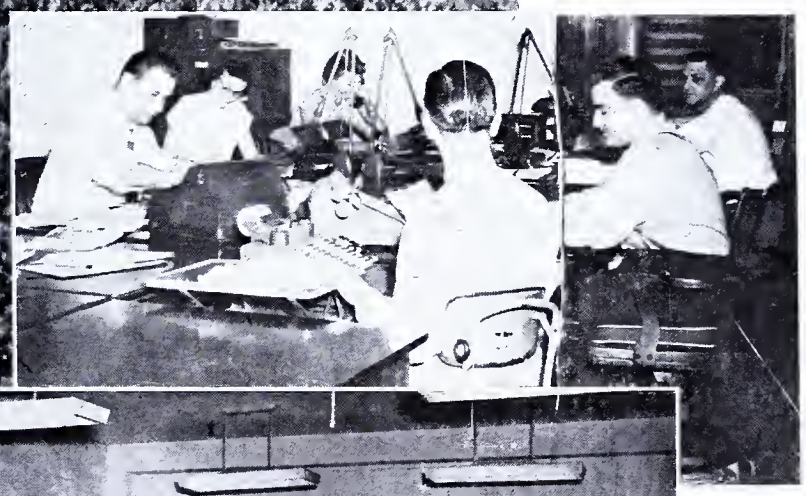
▲ Office Engineer-Plans

▲ Public Relations Department

Right-of-way Department ▶

Purchasing and Transportation Department ▶

▼ Construction Accounting Department



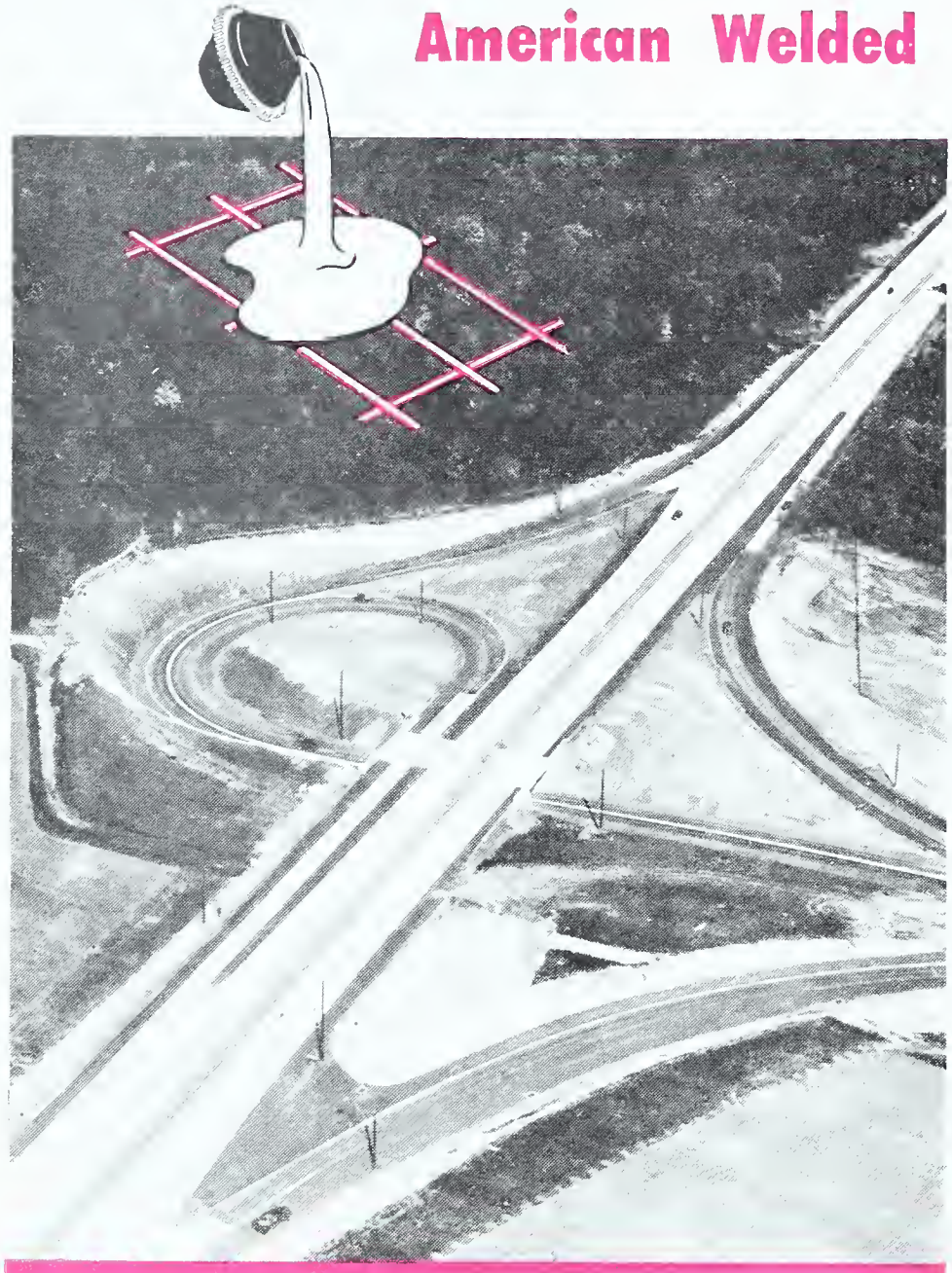
▼ Operating Accounting Department

◀ Fare Revenue-Records Department

Building Inspection Department ▶

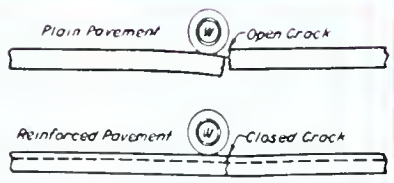
On the Pennsylvania Turnpike

American Welded Wire Fabric



Longer paving slobs, fewer joints, improve riding qualities on concrete highways reinfarced with Americon Welded Wire Fabric. Reduced rate of crocking, prevention of heoving ond spalling, alsa reduce mointenonce costs, increose service life of the highway.

As the wheel laad appraaches an apen crack in plain pavement, ane slab end carries the entire laad. As the wheel laad appraaches the clased crack in pavement reinfarced with American Welded Wire Fabric, bath slab ends, instead af ane, carry the laad, preventing damage ta the slab and ta the subgrade.



THE men who plan and build our modern concrete superhighways have helped to make American Welded Wire Fabric the world's most widely used reinforcement for pavement construction.

American Welded Wire Fabric keeps cracks that may form tightly closed—preventing progressive damage — distributes stresses, strains and impact in all directions.

U·S·S American Welded Wire Fabric reinforcement in rolls or in flat sheets is easily handled, lies flat and stays in place. This means important savings in labor costs and construction time.

Standard styles of U·S·S American Welded Wire Fabric are available in every locality from jobbers' stocks when furnished in rolls. When flat sheets or special styles of fabric are required—you can depend upon our Donora, Pa. and Joliet, Ill., mills to maintain your construction schedules.

When you are planning any type of concrete construction, our technical staff will supply complete data on specific designs and standard styles of fabric that are most readily available. Literature containing valuable information is also available. Write to our nearest sales office today, you incur no obligation.

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Keystone Automobile Club Hails The Pennsylvania Turnpike

By J. Maxwell Smith
President, Keystone Automobile Club

SINCE the opening of the original section of the Pennsylvania Turnpike in October, 1940, up to April 30, 1950, the great expressway from Middlesex to Irwin has carried 33,754,574 vehicles, of which 29,425,038 were automobiles. Motorists paid a total in excess of $11,000,000 for the privilege of riding over a superlative highway without the annoyance of frequent stops, congestion and conflict with cross-traffic. And they considered themselves well repaid for the expenditure in comfort of travel, absence of hazards and a sense of relaxation not experienced on highways beset with multitudinous distractions.

For these and other reasons Keystone Automobile Club felt it would be eminently desirable to extend to the motorists in Southeastern and Western Pennsylvania the advantage enjoyed by those who found it expedient to use the 160-mile existing Turnpike.

Our interest was not confined to wishful thinking. Before James H. Duff became governor—on May 1, 1946, to be explicit—we submitted to him, as Attorney General and gubernatorial candidate, a lengthy memorandum on suggested Pennsylvania highway policy.

Excerpts from that memorandum and a later letter to him as Governor under date of February 28, 1947, are of interest in keeping the record straight and demonstrating the club's well-considered program involving the motorist welfare in extension of the Turnpike, East and West.

"A toll highway paralleling a free road," we said, "offers the motorist a choice in accommodations. He may travel free on the one or pay fare on the other, if he considers the saving of time or other factors are worth it. But he is not forced to use the toll road as he would be if it were built as a replacement for an existing free highway.

"Whichever road he travels, the motorist's contribution to the Motor Fund is the same. Gasoline used in driving on the toll road is taxed for the benefit of the free highway system. The toll is for deluxe service similar to the added charge for Pullman service on the railroads.

"We believe, therefore, that the Pennsylvania Turnpike should be extended to Philadelphia and Pittsburgh, as already provided by two Acts of the Legislature, If, as we understand the Acts, this can

be accomplished through private financing, entirely independent of the Motor Fund, without involving the credit of the Commonwealth, but with the very definite guarantee of eventual inclusion in the free highway system.

"Extension of the Turnpike would benefit the motoring public in six ways: (1) By providing an entirely new facility without cost to the Motor Fund or any vehicle owners except those willing to pay for using it; (2) by relieving regular State highways adjacent to the Turnpike of congestion and physical hazards caused by heavy-duty traffic; (3) by supplementing the receipts of the Motor Fund through the liquid fuels tax collected from toll road users; (4) by freeing the streets of nearby urban communities for local use through diminution of through traffic; (5) by reducing maintenance costs on regular State highways in ratio to the heavy-duty use of the toll highway, and (6) by reducing the exposure to accident of people in heavily populated communiites.

"We could consent to Turnpike extension only on the basis of financing through private capital because it is unthinkable that the populous sections of the State should be deprived of funds necessary for the improvement of vital access highways by reason of the use of huge sums from the Motor Fund for deluxe express roads.

"We say this with full realization that toll roads in this day and age are an anachronism, to be tolerated only on the ground that they can provide entirely new and gravely needed facilities in shorter time than the State could construct them wtih monies from the Motor Fund without throwing the remainder of the highway system out of balance.

"Under no conceivable circumstances will the Club give its support to any proposal for construction of a toll road unless an ironclad recapture clause is incorporated in the agreement, absolutely guaranteeing its reversion to the State for free public use when toll payments shall have retired the indebtedness.

"Likewise, Keystone will never consent to any plan which contemplates construction of a toll highway as a replacement or substitution for an existing facility. Neither will the Club stand by as a disinterested spectator if, with the building of a toll highway, parallel free routes are neglected."

We found it necessary in the early stages of Turnpike Extension discussion to combat vigorously—and effectively—a concerted campaign of misrepresentation —and not a little villification—by selfish interests opposed to the project. They talked of neglect of roads paralleling the original Turnpike and moaned dolefully of "ghost towns" on the William Penn and Lincoln Highways. We found both highways comparable with the best in the State and the "ghost towns" to be filled with cars whose owners were doing business unhampered by the great volume of "through" traffic which formerly caused congestion and peril in the communities.

We fought down the accident bugaboo raised by the anti-toll interests, who sought to show the Turnpike was more dangerous than parallel roads. For many months Keystone continued to show up the fallacy of arguments against extension of the highway until the hullabaloo of opposition died down to a whisper.

Completion of this modern highway marks a bright epoch in Pennsylvania road building. Its cost will be borne by those who use it. There is not financial burden piled up against the State. Cities and towns by-passed by the new facility will benefit materially by a lessening of unprofitable but burdensome "through" traffic, and the motorist will have his choice of using existing free roads or en-

(Continued on Page 142)

Traffic and Earnings on Pennsylvania Turnpike System

By Lawrence S. Waterbury, Partner
Parsons, Brinckerhoff, Hall & Macdonald, Engineers, New York

THE CONSTRUCTION of the Pennsylvania Turnpike removed the most serious barrier to transcontinental highway travel through the State of Pennsylvania, and the Philadelphia Extension which is now under construction and scheduled for completion this Fall will eliminate the delays and hindrance to rapid and safe travel through the congested City areas in the eastern part of Pennsylvania. Also under construction at this time is the Western Extension of the Turnpike, which will extend the Turnpike from its present Western terminus at Irwin to the Ohio State Line thus eliminating the delays to travel through the congested City of Pittsburgh and the surrounding industrial region. When this Extension is completed and also the Philadelphia Extension, it will make possible a non-stop trip of 327 miles across practically the entire State of Pennsylvania over a continuous modern express highway.

In 1938 our firm made a report on Traffic and Earnings for the then proposed Pennsylvania Turnpike and on the basis of this report, the project was financed, construction completed and the Turnpike opened to traffic on October 1, 1940. During the course of our traffic investigations in 1937 and 1938, we made extensive traffic surveys in Central Pennsylvania and estimated that during the first year of operation the receipts from tolls would amount to $2,670,000. During the first year of operation, the actual revenue from tolls was $2,728,-397.00.

In order to arrive at the desired estimates of traffic, tolls, and the resulting gross earnings likely to be received from tolls on the Philadelphia Extension and the Western Extension, our investigation required a considerable variety of determinations not only of basic facts as to the existing traffic on the Pennsylvania Turnpike and surrounding region, but also as to the trends of growth, the attractiveness of the new highway to vehicles now following other routes and the effect upon them of the time saving, economy in operating costs, safety and other related factors.

The traffic prospects for the Philadelphia Extension will be primarily derived from the east and west flow of vehicles across Pennsylvania between the Susquehanna and Delaware Rivers. We therefore investigated the various origin and destination surveys which have been made in the principal cities in this area.

The Pennsylvania Department of Highways, Planning Division, during 1946 and 1947 made a number of extensive traffic surveys at Philadelphia, Coatesville, Downingtown, Lancaster, Reading and Harrisburg. These surveys in general included the interviewing of all vehicular traffic passing in either direction through stations established on each highway and road of any importance at its entrance to the area being surveyed.

Automatic recording stations were operated at various times during the period of the surveys to insure accuracy in the results. Manual volume counts were also made at each station which served to control the work of the interviewers. The interviewers noted the type of vehicle, its State of registration, the origin and destination of the trip, and other pertinent data obtained from the driver of the vehicle.

Some of the surveys included personal interviews of a portion of the residents at their homes or places of business. Results then were used to check the external survey with respect to vehicles having origin or destination within the area.

The results of the surveys were coded on the interview cards and punched on International Business Machine cards. These were then sorted for use in the traffic analysis.

The tabulated results from the sorting of the cards were carefully examined with respect to origin and destination and class of vehicle, and the location of the station at which the interview occurred. From this examination it was determined which vehicles might have been potential users of the Philadelphia Extension.

In analyzing the various traffic surveys, the origin and destination records were studied as noted, and the routes which the individual or group of vehicles traversed were traced, and only those vehicles which would have found some advantage in using the Philadelphia Extension, or might just as well have used it, were considered as prospective patrons. The remainder were rejected.

The vehicles considered as prospects might have made a trip the full length of the Philadelphia Extension, or used only a portion of it. These portions of trips were added together to make equivalent through trips. Therefore it is apparent that the total number of vehicles expected to use the Turnpike System, including the Philadelphia and Western Extension would be considerably greater than the figure for equivalent full trips which is used in our reports.

The total number of prospects was then reduced for sales resistance to the payment of tolls. This figure was then expanded to allow for the anticipated growth in traffic volumes between the time of the survey and the first year of operation of the project.

In addition to this normal increase in traffic, experience has shown that the introduction of a new highway route, bridge or vehicular tunnel tends to create traffic which did not exist prior to its opening. This is known as "facility increase" and has ranged from 40 percent in some cases to over 100 percent in others.

In case of the Pennsylvania Turnpike System, with its length and wide divergence of its sources of patronage, we have considered it more conservative to express this enlargement of traffic as an accelerated growth during the years following its opening rather than to estimate a larger traffic growth in its first year.

In making our reports on traffic and earnings for the Pennsylvania Turnpike System, we investigated the records of the actual experience on the original Pennsylvania Turnpike. During 1948, the total number of vehicle miles of travel for passenger cars was 238,107,182; for trucks 87,750,675; for buses 3,752,-137 or a total of 329,609,944 for all classes of vehicles.

For the period from the opening of the Turnpike on October 1, 1940 to December 31, 1948, the percentage of the total traffic, based on vehicle miles, was 75.2 for passenger cars, 23.6 for trucks and 1.2 for buses. For the same period the percentage of the total toll revenue was 41.0 for passenger cars, 56.5 for trucks and 2.5 for buses. The average revenue per vehicle mile during the same period has been $0.0092 for passenger cars, $0.0403 for trucks, $0.0357 for buses and $0.0168 for all classes of vehicles.

To the traffic estimated to use the Philadelphia Extension in 1951, we have applied the same rate of toll per vehicle mile as now charged on the Pennsylvania Turnpike. We estimate the total number

(Continued on Page 126)

Pennsylvania Stone Producers Association Pay Tribute to The Turnpike Commission and The Contractors

THIS IS a memorable occasion. The opening and dedication of the Philadelphia extension of the Pennsylvania Turnpike marks the completion of a gargantuan undertaking well and speedily done.

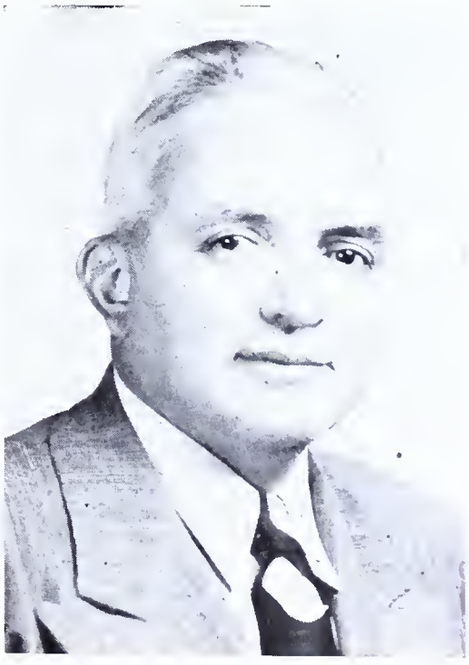
The apparent ease with which the almost unsurmountable difficulties encountered were surpassed is a tribute to the engineering skill and ability of the engineers and employees of both the Turnpike Commission and the Contractors involved in this construction.

The foresight in planning, the meticulous attention to the smallest detail, and the broad concept of the potentialities of the finished structure, are an index of the character and ability of the members of the Pennsylvania Turnpike Commission.

We, the officers and members of the Pennsylvania Stone Producers Association, are proud of our part in this project, and join with the entire citizenship of the Commonwealth in proferring our congratulations to the Pennsylvania Turnpike Commission, its engineers and employees upon the completion of this undertaking.

H. H. WAGNER
General Manager, P. S. P. A.

T. C. McPOYLE
President, P. S. P. A.



Furnishing Coarse and Fine Aggregate For The Eastern Extension of The Turnpike

By Hershey Miller, Engineering Representative Pennsylvania Sand and Gravel Producers Association

WHEN the original section of the Pennsylvania Turnpike was opened to traffic in 1940 many highway engineers looked upon it as a white elephant and a pipe dream not a dream highway. But to-day Walter Jones, Thomas J. Evans, Edward N. Jones, Charles Carpenter and Frank Bebout are haled as pioneers, whose very boldness and far signtedness made their achievement great and an outstanding accomplishment in modern transportation.

Engineers had estimated that revenues on the original section of the Turnpike would increase from $2,500,000 in 1941 to about $4,000,000 in 1945 and then stabilize at that figure. Revenues in 1949 were about double these estimates, indicating that road users are willing to pay for super-service.

To-day Thomas J. Evans, James F. Torrance, James J. Coyne and Edward N. Jones head an organization which has linked the present Turnpike at Middlesex with the great industries and port facilities of Philadelphia with bridges and ribbons of concrete. But to-day engineers from every State and many countries have come to study methods and procedures, and have returned home to emulate Pennsylvania by building express thru-ways.

PLANNING In an undertaking of the magnitude of the construction of the eastern extension of the Turnpike it is essential that; location, roadway design, structures, inter-changes, grades and curves, receive the careful study of competent engineers and that a careful analysis be made of all material requirements, location of supply, probable production and how, where and when it is to be delivered.

In the Fall of 1948 the Engineering Staff of the Turnpike Commission conferred with representatives of the material producers, and presented a schedule of material requirements, keyed to the construction schedule. After a careful study of this schedule, our industry again conferred with the Commission and stated that we had sufficient productive capacity to meet the schedule, provided we received the cooperation of the Commission and contractors, this cooperation to include adequate stock piles, shipment schedules geared to construction schedules and prompt unloading and return of cars to carriers.

As can be seen in Table No. 1, Approximate Material Requirements, shipments increase from about 150 cars each containing fifty tons, in January 1949 to 3000 cars in September 1949 and then to about 4000 cars in June and July 1950. Fortunately much of the coarse aggregate was produced within truck haul of the projects and this relieved an acute situation, due to a shortage of the gondola type cars. In 1949 the carriers were able to meet shipping schedules, and with adequate stock piles, very few delays could be charged to lack of aggregates.

Fine aggregate, however, presented a different problem. Much of the fine aggregate had to be shipped by rail. In 1949 under normal operations of other industries, shipping schedules were maintained and material supplies were adequate. In 1950 when the steel industry was competing for cars to build up depleted stock piles of coal, ore and stone, the car supply became critical. The carriers were unable to furnish sufficient cars to meet schedules, and some contractors were forced to curtail operations. To some extent this condition could have been averted, if contractors had stocked materials, however such procedure was not popular, due to cost of rehandling.

The carriers also found that the most efficient use was not made of the available equipment. Cars were allowed to stand on sidings until needed, instead of being unloaded promptly on arrival. Prompt unloading and return of empties would have added materially to the carrying capacity of available equipment.

The Commission, realizing the importance of cooperation with the carriers, assigned an engineer to assist the producers and carriers in keeping the supply equalized to the various projects. By this method it was possible to keep projects on schedule instead of some projects over-supplied, while others were closed down.

PLANNING PAYS OFF By careful planning it has been possible to complete the eastern extension of the Pennsylvania Turnpike on schedule. While our industry has played a relatively minor role, it has been an important cog, and we feel proud that we have had a part in its construction.

Pennsylvania Turnpike Commission —Philadelphia Extension
Approximate Material Requirements (Preliminary)

CONCRETE

	Tons Course Aggregate	Tons Sand
1948		
November	651	311
December	1,999	954
1949		
January	5,155	2,460
February	6,032	2,879
March	12,596	6,012
April	19,118	9,125
May	19,117	9,124
June	20,589	9,827
July	22,305	10,646
August	32,484	15,504
September ...	99,219	47,355
October	96,874	46,236
November ...	83,107	39,666
December	15,504	7,400
1950		
January	10,298	4,915
February	5,702	2,721
March	5,700	2,721
April	91,748	43,790
May	111,066	53,010
June	140,208	66,919
July	136,874	65,327
August	29,121	13,899
September ...	29,121	13,899
Totals ...	994,588	474,700

Ventilation and Control of Carbon Monoxide In Pennsylvania Turnpike Tunnels

By Gerald B. Gilbert, Safety Engineer

IT WAS JUST about ten years ago—to be specific on October 1, 1940—that the Pennsylvania Turnpike was opened for traffic from Irwin to Middlesex, a road of the most modern design; in fact the most modern highway in the world. Four lanes with no cross-traffic and no stoplights; one hundred sixty miles long through the Counties of Westmoreland, Somerset, Bedford, Fulton, Huntingdon, Franklin and Cumberland; across and through the Appalachian Mountain barrier which had heretofore always impeded transportation progress across the State of Pennsylvania.

The Turnpike construction, which included seven tunnels, introduced with them the problem of ventilation and carbon monoxide control on perhaps a much greater scale than had ever heretofore been introduced on any one highway. These tunnels, with a roadway 28 feet wide and a ceiling height of 14 feet, with an air-duct over top of the roadway ceiling in the semi-circular roof segment, vary in length from the shortest of 5/8 mile for Ray's Hill Tunnel to the longest of 1 3/8 miles for Sideling Hill Tunnel. A very definite form of ventilation was required not only to keep the tunnel clear of smoke and fumes from vehicular traffic but also to keep it sufficiently free of carbon monoxide from motor vehicle exhaust to render it safe for the traveling public.

The Turnpike Commission engineers turned to studies made in the Holland Tunnel under the Hudson River at New York City in order to obtain certain essential facts for the design of a ventilating system. These studies showed that the average carbon monoxide content of exhaust gasses from vehicles was approximately 6.8 per cent, and further showed and determined that four parts of carbon monoxide in ten thousand parts of air is permissible for human occupancy. With these fundamental facts as a starting point and with the traffic volumes as predicted by the Traffic Engineers, it became a reasonably simple computation to determine the quantity of air necessary to create dilution of carbon monoxide required to keep it within safe limits.

Take Sideling Hill Tunnel as a typical example for a discussion of the design of ventilation. We find that there was required approximately 1,200,000 cubic feet of air per minute in order to provide for proper dilution of carbon monoxide at maximum traffic density. Traffic volumes also give the following rather interesting statistics:

The traffic volume requiring maximum ventilation was predicted to occur during approximately 10 hours per year or 1 1/2 tenths of 1 per cent of the year. Traffic requirements would indicate that for a period of 1,485 hours or 17 per cent of the year 1/2 of the maximum ventilation would be required; that for 2,540 hours or 29 per cent of the year 1/4 of the maximum ventilation would be required; that for 3,850 hours or 44 per cent of the year 1/8 of the maximum ventilation would be required; and finally for 875 hours or approximately 10 per cent of the year no mechanical ventilation would be required.

It is interesting to note that in forced ventilation the volume of air varies directly as the speed of the fan, whereas the pressure varies as the square of the speed of the fan, and the horsepower consumed varies as the cube of the speed of the fan. From this we can see that it would not have followed the best principles of economics had one large fan been used with the necessary volumes controlled entirely by the variation of speed; and as a practical and economical solution of this problem the decision was made to ventilate the tunnels by the use of four fans, two at each end, with the design providing for these fans to be operated at three different speeds; namely, full speed, half speed, and quarter speed.

Going back to our problem of Sideling Hill Tunnel, we find that for 10 hours or 1 1/2 tenths of 1 per cent of the year we would operate all four fans at full speed with a power consumption of approximately 400 horsepower; that for 1,485 hours or 17 per cent of the year we would operate all four fans at half speed, consuming approximately 50 horsepower; that for 2,540 hours or 29 per cent of the year we would operate all four fans at quarter speed consuming approximately 6 1/4 horsepower; that for 3,850 hours or 44 per cent of the year we would operate two fans at quarter speed consuming approximately 3 1/8 horsepower; and that the balance of 875 hours or 10 per cent of the year no fans would be required.

Let me digress here to speak a few minutes about the matter of natural ventilation. First, the prevailing winds provide some natural ventilation through these tunnels and, second, a variation in barometric pressure (that is, higher pressure in one valley between one pair of mountains than the corresponding barometric pressure in the other valley between another pair of mountains) tends to produce a chimney effect or a natural ventilation through the tube itself. This natural ventilation is somewhat different than that encountered in sub-aqueous tunnels as we find near New York City, since the grades through the Turnpike tunnels from portal to portal are so flat as to consider the tunnels almost level. I would like to point out that 1/8 of the maximum required ventilation, which is needed during 44 per cent of the year, requires a ventilation of 150,000 cubic feet of air per minute which, based on the tunnel cross-section, requires a velocity of about 375 feet per minute or, roughly, 6 1/4 feet per second or 4 1/4 miles per hour. It is interesting to note at this point that during 54 per cent of the year the ventilation requirements are 1/8 of maximum or less. Therefore, a prevailing wind of 4 1/4 miles per hour blowing through the tunnel or a difference in barometric pressure sufficient to produce a flow of air of 4 1/4 miles per hour would provide the required ventilation for more than half of the year.

The fans installed in the Pennsylvania Turnpike tunnels are of a 7-vane silent double-width double-inlet type, 110 inches in diameter. All of the fans are identical in size and design and the different ventilation requirements are controlled by different speeds at different pressures in different tunnels. These fans are driven with two motors, one larger motor being used at maximum speed for maximum ventilation and the other smaller motor being used for slower speeds and lesser ventilation.

Let us now take up the matter of control of carbon monoxide. First as to the matter of detection, we have in each tunnel two analyzers and two calibrators which are continuously operated, drawing air samples from each half of the tunnel and continuously analyzing such samples for their carbon monoxide content. Although 4 parts of carbon monoxide in 10,000 parts of air is considered safe for human occupancy, nevertheless due to the fact that tunnel-operating personnel may be in the tunnel for long continuous periods of time we determined it advisable to keep the carbon monoxide considerably less than 4 parts. I have heretofore mentioned the necessity of ventilation in order to keep the tunnel clear of smoke; and I might add that on many occasions the ventilation requirements to keep the tunnel atmosphere clear and eliminate the smoke from exhaust gasses are such that they keep the

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How the Turnpike System Began

(Continued from Page 74)

cent; curves limited to 6° having a radius of 995'. The estimated cost of construction, exclusive of engineering and administrative costs, was fifty million dollars. The report suggested that such a highway be constructed, operated and maintained by an authority or commission to be created by legislative enactment, such commission or authority to have power to issue revenue bonds which would incur no obligation whatsoever upon the resources of the Commonwealth. These bonds were to be liquidated from tolls or other revenues derived from the operation of the highway, and when paid for, it would revert to the Pennsylvania highway system as a free road.

This was a very lengthy report and developed a great deal of information which is still used today as a yardstick for such projects. The report recommended that a bill be introduced in the Legislature for the construction of such a project and provided for a Commission and that public hearings then be held to determine the advisability of passage of the bill. The report was signed unanimously by the Legislative Commission.

On March 9, 1937, the Patterson Turnpike Bill (H.B. 1284) was introduced in the House of Representatives. This Bill provided for the appointment of the Commission, fixed the salary of the Commissioners and invested complete power in the Commission. After approval by both the House and the Senate this Bill was signed by Governor Earle on May 21, 1937 and became 1937 Act #211, Pennsylvania State Laws.

Later Governor Earle appointed Walter A. Jones of Pittsburgh, Chairman of the Turnpike Commission. Other members appointed Charles T. Carpenter of Glen Moore, Chester County; Frank Bebout of Monongehela, Washington County; Edward N. Jones, former W. P. A. Administrator, and Warren Van Dyke, Secretary of Pennsylvania Department of Highways, Ex-Officio.

During 1936 Associated Pennsylvania Constructors helped to broaden interest in the "Dream Highway" by publishing in HIGHWAY BUILDER several articles and reports on the surveys and studies then in progress. However, it was in April 1937 that this Association executed a master stroke while the report of the Legislative Committee and enabling legislation were being considered. A special 44-page number of HIGHWAY BUILDER was published, containing nothing but facts, information and illustrations about the proposed turnpike. Included were: Many pictures of the original South Penn right-of-way, tunnel entrances, and the then — existing modern super divided highways; articles written by Governor George H. Earle, Secretary of Highways Warren S. Van Dyke, Chief Engineer of the Pennsylvania Department of Highways, H. H. Temple; a lead article giving all of the early history by Thomas Meehan, then publicity director of the Pennsylvania Department of Highways; a very important article by the late Major General E. S. Shannon, Commanding General of the 28th Division of the Pennsylvania National Guard, regarding its military value; information and maps as to the proposed right-of-way, location of tunnels, and amount of employment which would be created; an article by the late W. A. Sutherland, General Manager of Pa. Motor Truck Association, outlining the benefits to the motor truck transportation industry; an article by Edward Flickinger and many others.

This complete condensation was published in sufficient quantities so that all interested parties, including the entire engineering and construction industry, as well as legislators and public officials, were able to have the complete story. Great numbers of legislators informed us that it was the facts presented in this issue of HIGHWAY BUILDER which decided their vote for the legislation necessary to proceed with this project.

In 1938 P. W. A. granted $29,250,000, and the Turnpike Commission sold $40,800,000 bonds to the Reconstruction Finance Corporation. Later these bonds were purchased by the R. F. C. by B. J. Van Ingen and Company.

Some of the first employees of the Commission who took an active part in the organizing were Samuel W. Marshall, Chief Engineer of the Pennsylvania Department of Highways; Roger B. Stone, Engineer in charge of construction; W. J. Buchy, office engineer; John D. Paul, plans engineer; Harry L. Lundy, chief of surveys, and the late John D. Faller, counsel for the Commission.

The first contract for the Turnpike's construction was let on October 26, 1938, and the ground-breaking ceremonies took place on the following day.

1939 witnessed the greatest buzz of construction and events that the State had ever known up until this time, and volumes could be written on the events of the period which ended with the Turnpike's opening and dedication on October 1, 1940.

Today finds Associated Pennsylvania Constructors fired with enthusiasm for the extension of the Pennsylvania Turnpike System. The nebulous dream of Edward Flickinger has been transformed into a practical, useful utility whose benefits cannot be counted. From its earliest days the Pennsylvania Turnpike has consistently challenged our interest and our efforts. Its successful record has justified our confidence; its future expansion will have the same support and assistance which has marked our proud participation in its development to date.

Cooperation Received From Contractors and Others in Building the Phila. Extension

(Continued from Page 54)

tegrated into a smoothly operating machine, produced a finished product — the Philadelphia Extension — it is clearly understood and realized that such an accomplishment was possible only through the closest of team-work and the wholehearted cooperation of each individual participant.

Hail the Pennsylvania Turnpike!

The greatest highway building achievement of the century--in which we are proud to have been contractors

May Pennsylvania continue to lead the Nation in modern highway construction progress

Ralph Myers Contracting Corporation

Salem, Indiana

BRANCH OFFICES

Box 125, Pitcairn, Pa.
Phone: Pitcairn 1178

Box 72, Denver, Pa.
Phone: 7-8731

Box 240, Cheswick, Pa.
Phone: Oakmont 3197

"We Move the Earth"

"History Repeats"

(Continued from Page 61)

Road increased to a point that a better highway became a necessity.

Consequently, on April 7th, 1792 a Charter was issued by the Pennsylvania Legislature for the construction of a toll road between Philadelphia and Lancaster. The description of the highway and the course to be followed was simple and brief. The Charter said "beginning at the West side of the Schuylkill River opposite the City of Philadelphia, so as to pass over the bridge on Brandywine Creek near Downingtown from thence to Witmer's Bridge on the Conestoga Creek and thence to the East end of King Street where the buildings cease in the Borough of Lancaster". The present Lincoln Highway crosses over the exact location in Downingtown and Lancaster where the original route was constructed.

The specifications for the highway were also extremely brief. Incidentally, the Charter provided for a right of way with 50 feet which, on some sections of the Lincoln Highway is still the legal right of way. As far as the specifications were concerned, the following described the method of construction "the road shall be 50 feet wide, 21 feet of which is to be an artificial road bedded with wood, stone, or gravel and any other hard substance well compacted together, a sufficient depth to secure a solid formation of the same, faced with gravel or stone pounded, or other small hard substance, in such manner as to secure a firm, and, as much as the material will admit, an even surface, rising toward the middle by a gradual arch."

For the purpose of construction the road was divided into five Districts with a Superintendent in each District. These men were directly responsible for the construction within each section and reported to the Managers of the Road. From all the records their duties were comparable to the District Engineer in our present highway setup. The contracts for construction were awarded by the Managers of the Road. It seems that even in that period property owners attempted to influence the course of the highway. However, the reverse was true then, as to our present situation concerning property damage. Property owners in that day wanted the highway adjacent to one of their boundary lines. It seems also that politics played an important part in the award of some of the contracts. One Matthias Slough complained that he had submitted a bid for 200 pounds less than that of the contractor to whom the bid was awarded. Many of the families in the area worked on the road as construction laborers. Consequently in the fertile area work was retarded during the farming season and in the barren area where stone was plentiful it was difficult to secure labor immediately adjacent to the project.

The final cost of the road was $464,142.31. The average cost per mile was $6,629.00 for approximately 70 miles. If I remember correctly Governor Pinchot in his improvement of the rural highway system during his second administration built these highways at an average cost of approximately $6,000.00 per mile. Nine toll gates were provided — four in the first 20 miles from Philadelphia and the last at Witmer's Bridge at Lancaster. The other four were spaced according to intersecting roads, permitting entrance to the Turnpike.

The Turnpike was finally completed in 1796. The first regular stage carrying ten passengers left Lancaster in May 1797. The time of departure was five o'clock in the evening and it arrived in Philadelphia 5 o'clock the following morning. The charge for a horse and rider or for a lead horse was one sixteenth of a dollar for ten miles. For a two wheel sulky twice as much. For a "Coach, chariot, stage wagon, pheaton with two horses and four wheels $.25 for ten miles but if drawn by four horses or more the charge was 50% greater." Two oxen were considered the equal of one horse and a mule was the equal of a horse.

Even in those early days attempts were made to restrict the weight of traffic. Following is a quotation indicating the attempt to limit weight; "Nor shall more than eight horses be attached to any carriage whatsoever used on said road, and if any wagon or other carriage shall be drawn along said road by a greater number of horses or with a greater weight (3½ or 4 tons) than is hereby permitted, one of the horses attached shall be forfeited to the use of said company, to be seized or taken by any of the officers, or servants, who shall have the privilege to choose, excepting the shaft or wheel horse or horses."

Evidence of the tremendous amount of traffic using the highway is shown by the records whereby stock with a par value of $300.00 per share, paid in the year 1827 a divided of $72.00 per share. In 1819 a Company was organized with a Capital Stock of $35,000 to send two Conestoga wagons daily from Philadelphia to Pittsburgh. The rate to Pittsburgh was $6.00 per 100 cwt. Between the years 1792 and 1834 the volume of traffic increased tremendously. The opening up of the country West of Lancaster pushed the wagon roads Westerly from Lancaster to Harris Ferry (now Harrisburg) then to Carlisle and finally over the mountains to Pittsburgh.

Some sixty odd taverns or places for refreshment, or entertainment of overnight guests were spotted along the Turnpike. The early settlers were certainly class conscious as these hostelries were divided into four groups. The first was known as "Stage Stands", and provided entertainment and lodging for those who could afford to travel by the stage coach. The second classification was the "Wagon Stands". These were less pretentious and were for use only of those travelling by Conestoga Wagon or other vehicle comparable to our truck travel of today. The third classification was known as the "Drove Stands", for the use of those driving cattle. The lowest and final classifications were known as "Tap Houses". The Tap Houses were congregating places for the highwaymen, beggars, and others forced to travel on foot. The Tap Houses soon became meeting places for the bandits and others who lived outside the law. Robberies of the traveller were frequent and one rarely travelled the Turnpike without being properly armed. The long grade west of Coatesville, where the Lincoln Highway enters a slight gap in the ridge, west of the City, was a favored location for robbing the travellers. Stages and other vehicles were forced to travel this grade at a slow rate of speed and made an ideal location for lifting valuables from those using the Turnpike.

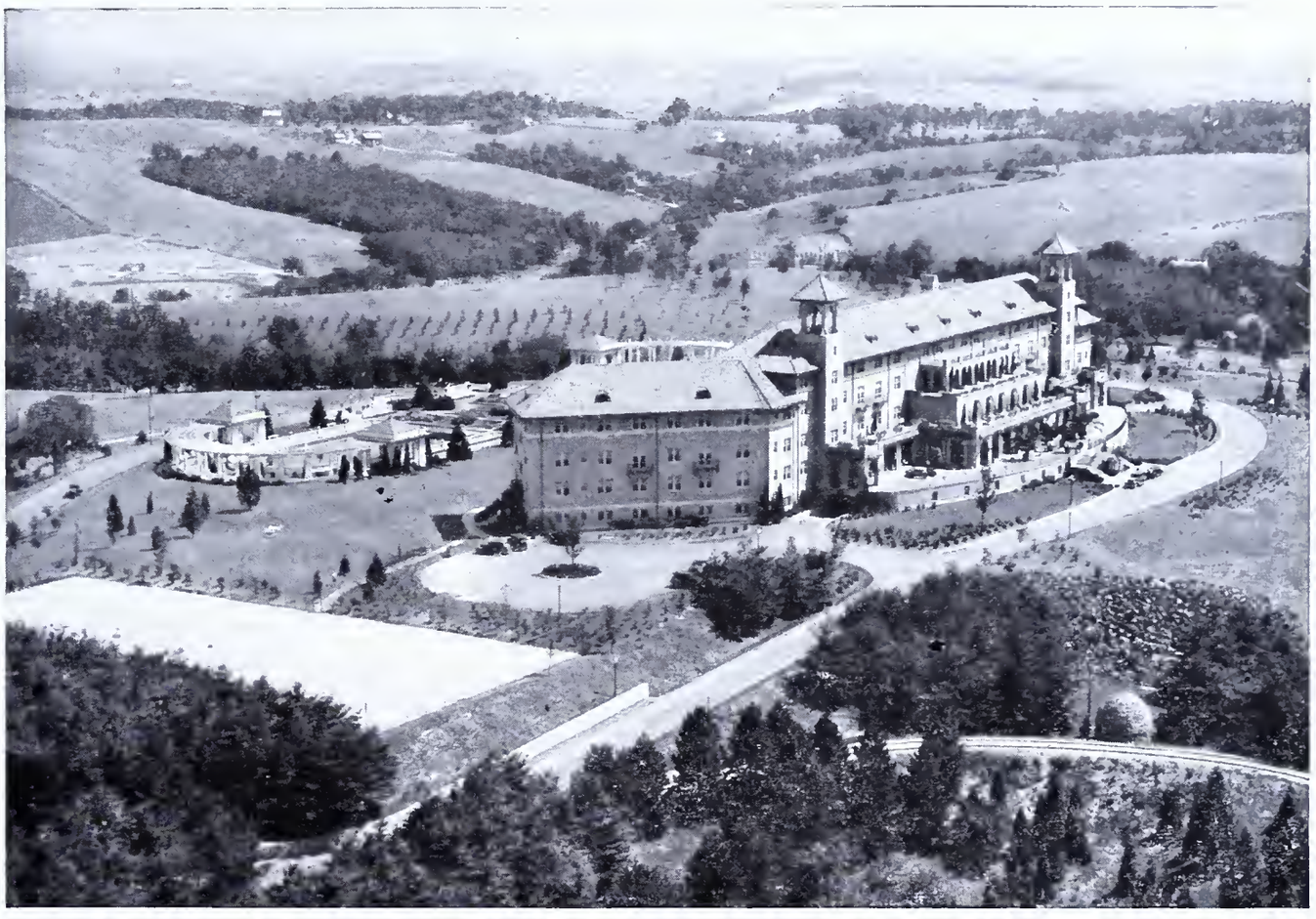
The building of the Railroad from Philadelphia to Columbia, which was the first division of the Pennsylvania Railroad; was the beginning of the end of the rushing business done by the Turnpike. However, there seemed to be a difference of opinion as to the value of the Railroad. Some people believed that the Railroad could not carry the freight that the old Conestoga Wagons carried. The first cars were horse drawn and made no better time than those traveling the Turnpike. However, in April 1834 the first locomotive drawn train made the trip from Philadelphia to Lancaster. The time required was 8½ hours, a saving of 3½ hours over the stage coach time for the same distance. In 1836 the locomotive completely replaced horse drawn railroad cars. From that time on stock in the Turnpike declined rapidly. In 1899 it returned only a dividend of $.25 on the original shares. In 1867 A. J. Cassatt and Associates bought the section of the Turnpike from Philadelphia to Paoli for $8,000.00. In 1917 the Commonwealth of Pennsylvania purchased this same section from the Cassett interests at a cost of $165,000. The last 12 miles was purchased by the State at a cost of approximately $90,000.00.

This in brief, is a history of the first major Turnpike constructed and operated by private subscription in the Commonwealth of Pennsylvania. It is interesting to note that both the first Turnpike and

(Continued on Page 119)

Hotel Hershey

In the Rolling Foothills of the Blue Mountains



"Delightful Living" is the rule of this charming hotel in the countryside of Hershey, Pennsylvania.

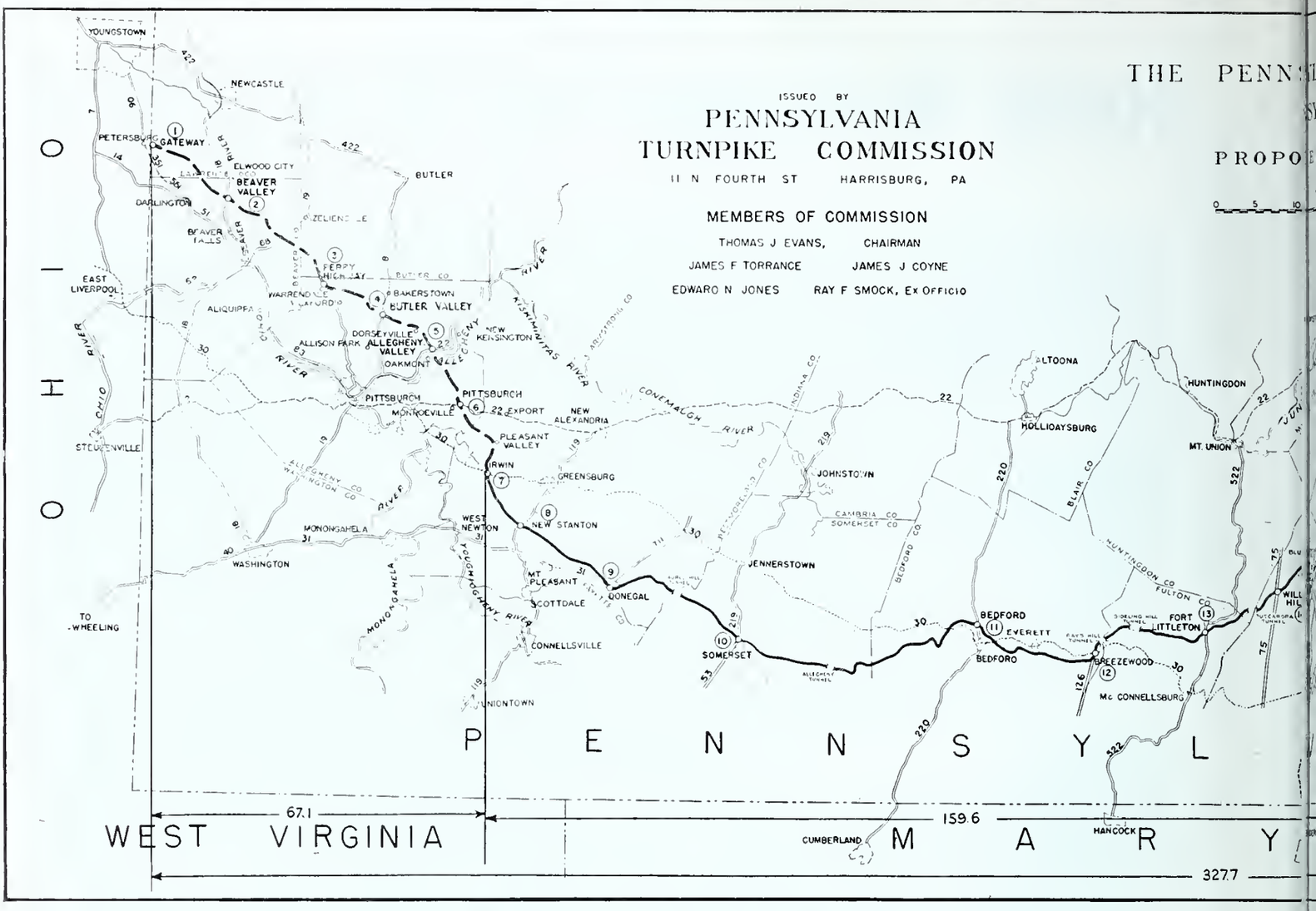
HERSHEY'S chocolate and cocoa products are first in favor and flavor throughout America. Come to "The Chocolate Town" and see these products being made. The Factory, located on Chocolate Avenue, is open to the public Monday through Friday weekly, except holidays.

The Community Inn, in the center of Hershey is a moderately priced hotel designed for comfortable living. The Grill - Oyster Bar has been modernized recently, adding a Cacao Lounge.

SPECIAL ATTRACTIONS — Coming soon to the Hershey Sports Areas: Ice Hockey, Hershey Bears vs. nine teams of the American Hockey League — Excitement! Thrills! —the most action for the least money.

Headed this way — the Ice Follies and the Ice Capades, 1951 Editions — amusing, beautiful, handsome and eye-filling skating entertainment.

The Hershey Lumber Products are makers of fine mahogany and walnut furniture. Ask your furniture or department store to see these Hershey tables of fine craftsmanship and distinction.



Interesting Facts About The P

Length

Original Turnpike from Irwin to Carlisle is 160-miles; the Philadelphia Extension from Carlisle to King-of-Prussia is 100-miles; Western Extension from Irwin to Ohio State line is 67-miles.

Type of Roadway

Modern four-lane reinforced concrete highway; each lane separated by a 10-foot center strip. Width of each traffic lane is 24-feet. There are 652 grade separations of all types along the 327-mile highway.

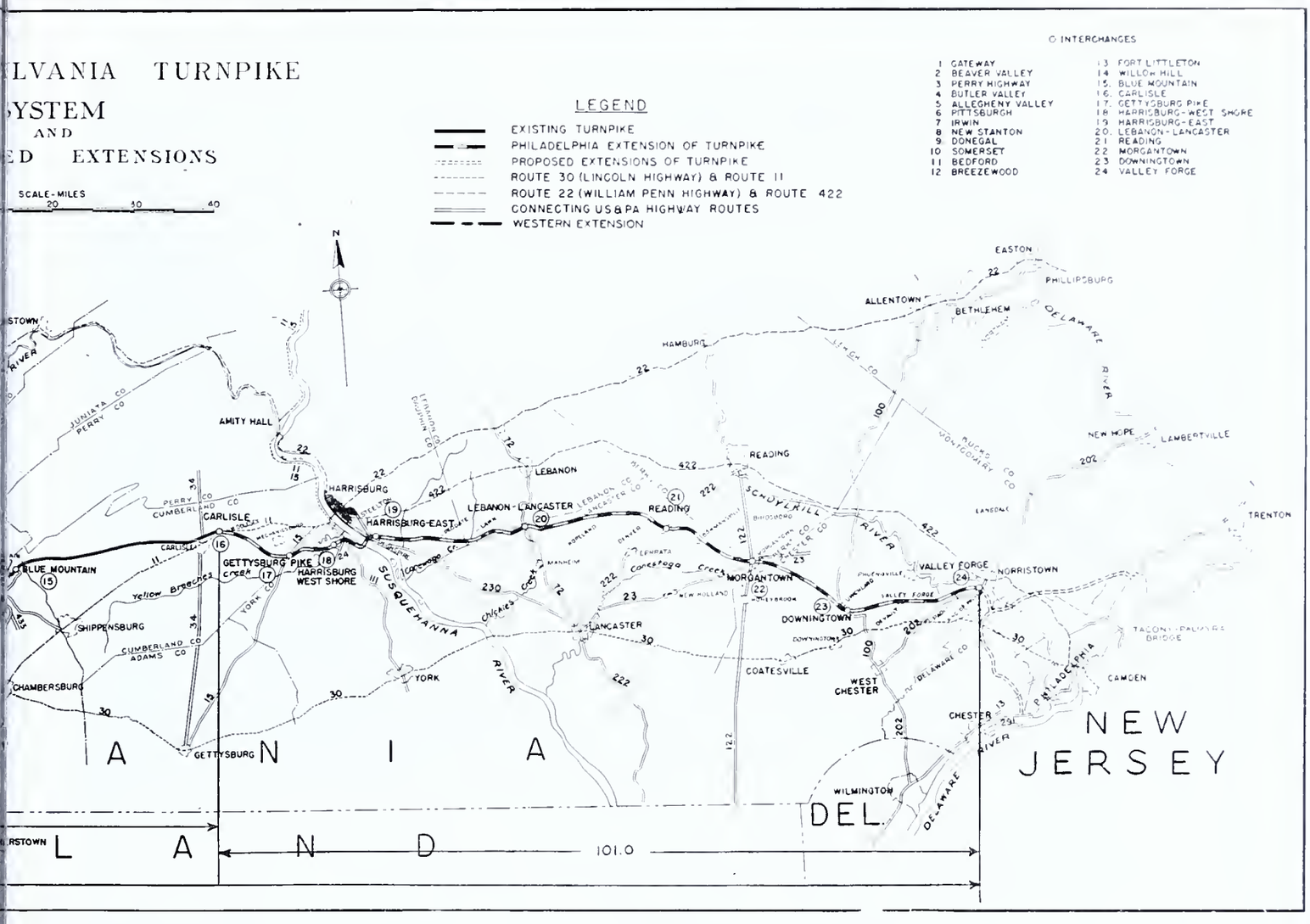
Grades and Curves

Maximum grade throughout entire length of the highway is no greater than 3 percent. Curves are limited to six degrees with radius of 955 feet, thus permitting the maximum sight distances.

Crossings

There are no highway crossings at grade anywhere along the route. At the 24 interchange points entrance and departure ramps are to the right and are constructed to permit motorists to enter or leave the super-highway with freedom and safety.

(Enabling legislation was approved in 1949 permitting the Turnpike Commission to build extensions



nnsylvania Turnpike System

Location

The Turnpike is so located to permit motorists and commercial traffic to travel the full length of the Commonwealth with complete safety under all weather conditions. There are no signal stops or congestion to slow down traffic, thereby reducing maintenance costs to users of this highway system.

Facilities

For the convenience of the motorists travelling the Turnpike, there are 21 service stations and restaurant areas. There are also 24 toll houses so located as to afford easy access to the super-highway from any direction of travel.

Military Significance

The Pennsylvania Turnpike is a major transportation artery in time of war. Men, munitions and other materials used in warfare can be moved across the State with the speed and efficiency that are so necessary in times of national stress.

Cost

The Turnpike System cost approximately 211 million dollars and is privately financed, and thus does not impose any additional taxes on the citizens of Pennsylvania. Through the tolls charged, the highway will pay for itself and in time will become a part of the State's free highway system.

m a point near Pittsburgh to the City of Erie, and from a point East of Harrisburg to Scranton.)

The Turnpike Crosses The Susquehanna

(Continued From Page 51)

cost of still longer spans was investigated by omitting one 4-span unit of 109-ft. spans. Keeping the same overall length and using 4-span units as before would result in the following increase in cost:

Saving in eliminating four piers	$ 44,500 x 4 —	$178,000
Increase in cost of 30 remaining piers due to the longer spans	$ 1,500 x 30 +	45,000
Increase in cost of steel superstructure for longer spans: Structural Steel 1,500,000 lbs. @ $0.15	+	225,000
Net increase in cost from this change		$ 92,000

As finally adopted, the deck girder spans are, from west to east, an 80-ft. end span, three 120-ft. girder spans which comprise a continuous unit, thirty-two 109-ft. spans in 4-span continuous units, and an end span of 70 ft. The total length of deck girder spans is 3,998 ft.

The spans over the railroad tracks at the east end are continuous rolled-beam spans consisting of three identical units of 46′-6″; 83′-0″; 46′-6″ spans having a total length for three units of 528′-0″. The overall length of the bridge is 4526′-0″.

Expansion joints must, of course, be used at intervals in a bridge of this length. It has been conventional in the past to locate the joints at the piers. After some study, it was decided to locate the joints at the 1/4 point of every span, i. e. every 436 ft., for example, in the 109-ft. spans. The advantages of so locating the joints are:

1. Only one shoe is required at each pier for each girder making it unnecessary to increase the width and therefore the cost of the pier because of the second shoe that would be required if the joint were at the pier.

2. When the roadway joint is placed over the pier, water falling through the joint often causes staining and sometimes spalling of the concrete unless special and costly gutters and drain pipes are provided. These in turn usually require maintenance and interfere with painting.

3. Whereas in this bridge, the end spans of each interior unit must for aesthetic and practical reasons be the same length as interior spans, there is a loss of economy in the end spans and even in the adjacent spans when the joints are placed at the piers. This would be especially true if curved girders had been used. The negative moment from the cantilever overhang at one end and the shorter span at the other end of the unit both decrease the maximum positive moments in the end spans.

Anticipating that steel erection would be from each shore towards the middle, the joints were so located that no falsework of any kind would be needed. This required a specially fabricated closing span at a pre-determined point near the middle. Only one pier in each continuous unit has a fixed shoe. This pier was designed to resist all longitudinal forces from the four spans attached to it longitudinally. Rocker shoes are used at all other piers. The girder bearings at expansion points carry a rather small load but the movement is relatively large. The bearings consist of "Lubrite" bronze plates. Distribution of the load to the bronze plates and provision for end rotation of the girders is accomplished by means of a small shoe with a pin. No uplift occurs at these bearings.

It was recognized at the start of the design that with careful attention to details, unusual duplication was possible and that savings in cost could be realized. In laying out the framing plan for the Superstructure, special attention was given to the arrangement of the floor panels which are uniform and rectangular except for the skew framing at the expansion joints that, in turn, are identical. Each four-span girder on one side is identical with the opposite girder if turned end for end. Similarly, duplication of forms for piers was carefully studied. Although each successive pier is about 3 inches higher from east to west, and although the downstream faces are, for almost compelling aesthetic reasons, battered, all expansion piers and all fixed piers could have been built with one set of forms for each. In fact, the contractor used only 3 pairs of forms for the twin shafts of the river piers above Elevation 304 — one pair for the fixed piers and two pairs for the expansion piers because there were almost three times as many of the latter. The same study of duplication extended to the beam spans at the east end.

The bridge deck consists of two 26-ft. roadways separated by a 4-ft. median having mountable curbs. Transverse drainage is from the center towards the outside curb where gutters and scupper outlets are provided. It is anticipated that this bridge will carry traffic travelling at exceptionally high speed. For this reason a height of 1′-8″ was adopted for the outside curbs. The curbs are stepped, the height of the lower step being 8″ and that of the upper curb is 1′-0″. Vertical faces are battered. 1½ per foot and the horizontal offset between them is 6″.

There is, of course, no ordinary pedestrian traffic permitted, but it was thought that provision should be made for an emergency walkway along the outer curbs. The outer edge of each curb is 2′-6″ from the gutter line thus providing shoulder clearance for persons using the walk but the actual width of the top of the curb available for a walkway is 1′-10½″. The inside face of the steel railway is in line with the edge of the curb. Its height above the curb is about 3′-4″ for protection to persons using the walkway and its height above the gutter line is about 5′-0″. The railing is composed principally of horizontal elements to obtain the maximum possible visibility from the roadway.

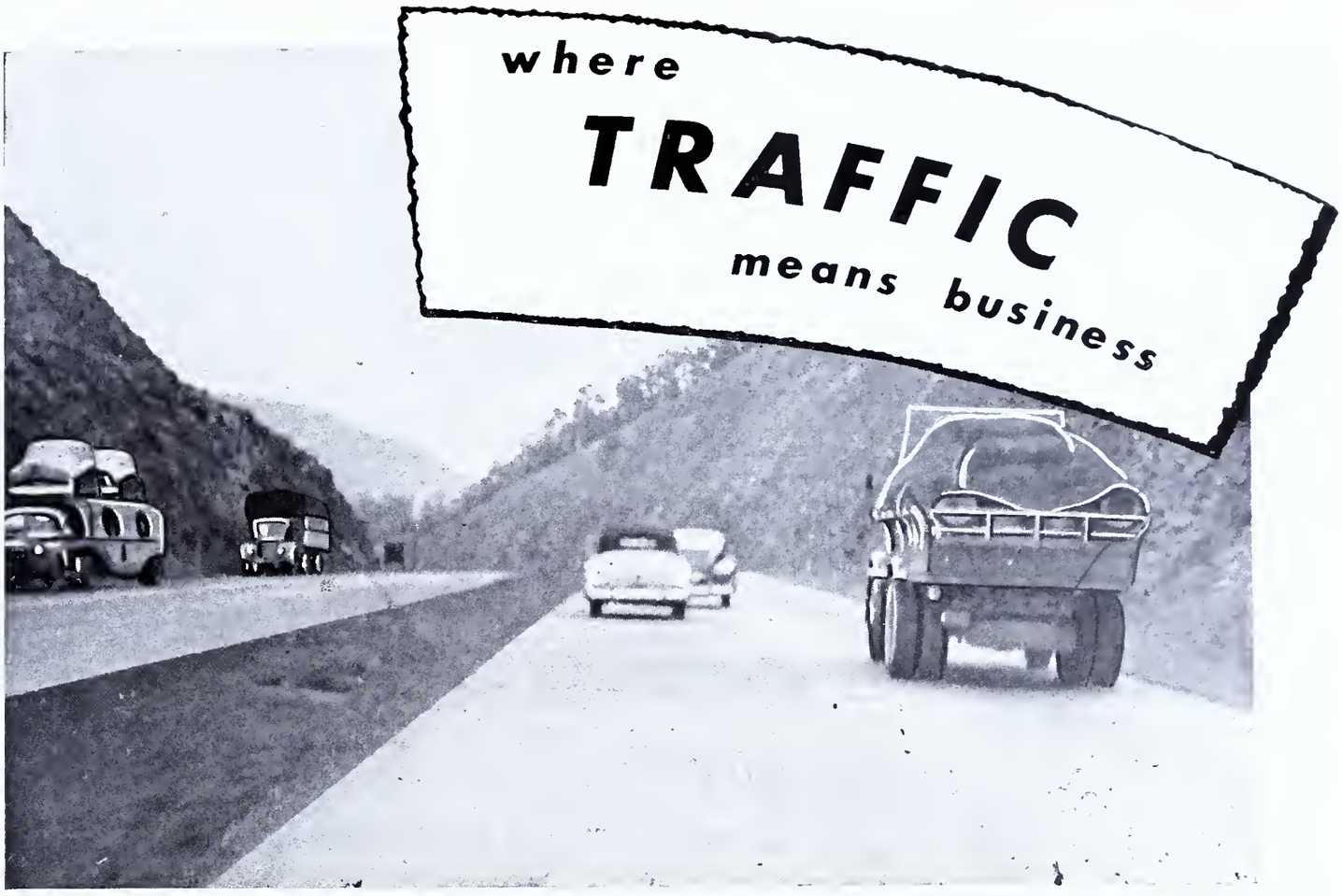
Except for the skew panels previously mentioned only two panel lengths of 24′-0″ and 27′-3″ are used on the girder spans. There are two lines of girders spaced 42′-0″ c. to c. The 10′-2″ projection of the deck and railing on either side is carried by cantilever brackets and one line of longitudinal stringers located 6′-6″ from the girder. There is no true fascia stringer.

One plane of bracing consisting of 6″ structural Tees (split W. F. beams) is provided near the bottom flanges of the floorbeams which are 5 ft. deep. A skewed, open-truss sway frame is placed at each pier to transfer to the shoes the lateral reactions; elsewhere the bottom flanges of the girders which are 8′-6″ deep are braced by knee-braces beneath each floorbeam.

The concrete deck slab is 8½″ thick. To the structural thickness required for the H20-S16 live loading there has been added 1½″ of concrete placed integrally with the structural slab to serve as a wearing surface.

Because of the skew, the relative economy of a two-girder versus a four-girder layout was studied. In fact, had it been necessary to place the piers in the west channel parallel to the west shore (a 9 on 12 bevel) it would have been necessary to use a four-girder layout with a longitudinal joint on the center line for the west crossing. In comparing the two layouts, several designs were studied to obtain the maximum economy in each layout. The two-girder design resulted in a total saving in cost of $250,000 of which $210,000 is the amount saved in the substructure.

(Continued on Page 128)



To drivers on the Pennsylvania Turnpike, THIS LOOKS FAMILIAR!

We wish it could be familiar on every highway, because this is TRAFFIC . . the kind that brings business to Pennsylvania and whose tolls pay for this road . . *traffic* that can jam outgrown streets and highways intolerably, cause safety hazards, produce profit-killing regulations . . but NOT HERE!

The Trucking Industry felicitates the Pennsylvania Turnpike Commission, the legislators and all the men of vision who today provide another hundred miles of highway engineered to handle modern traffic. These men know you can't have the flexible, economic service of motor transportation without the presence of trucks and cars on the roads.

They are building today for tomorrow's needs . . . . they are hanging out the welcome sign to TRAFFIC that means Business and National Security.

DID YOU KNOW?

Trucks pay 62.9% of the Turnpike vehicular revenue?

(Yet trucks make up only 23.3% of the Turnpike traffic!)

Trucks in Pennsylvania paid $44,903,000 in license fees and gasoline taxes in 1949?

(This was 170% of the State highway renewal and maintenance costs for that year!)

Trucks do and are willing to continue to PAY THEIR WAY!

PENNSYLVANIA MOTOR TRUCK ASSOCIATION

Seventh Floor — Telegraph Bldg., — Harrisburg, Pa.

Pittsburgh Hails The Pennsylvania Turnpike

(Continued From Page 77)

consider carefully transportation costs.

Substantial savings in transportation costs result from the long-distance movement of goods and products by motor freight carriers from loading platforms of plants and factories directly to the purchaser's doorstep.

The Pennsylvania Turnpike already provides many Pennsylvania manufacturers with lower transportation costs than their competitors. With the completion of the Philadelphia and Pittsburgh extensions, this advantage will be further increased, — an asset many manufacturers are taking into consideration in their current construction plans.

In addition the Pennsylvania State Highway Department has given the people and industries of the Commonwealth the largest and finest State highway system in the nation, — linking in a vast network busy industrial and mining communities to rich farms and dairylands.

Also lively new interest in Pittsburgh locations, which have the benefit of the Pennsylvania Turnpike as a means of transportation, has been created by the recent change in steel pricing methods. Following a United States Supreme Court decision, prohibiting the old multiple basing point system, and a veto by President Truman of the so-called "basing point" bill, the steel industry and other manufacturers must now quote prices for their products at the mill, thus favoring fabricators located close to abundant sources of steel and basic raw materials.

Pittsburgh, in the industrial heart of America with enormous production of metals of all kinds, offers fabricators unusual opportunities for the production of finished goods. Transportation via the Turnpike is a primary advantage to these fabricators.

Included among new industries that have already located in the Pittsburgh district since World War II are The General Motors Corporation, Kelsey-Hayes Wheel Company, and the Continental Can Company. These companies are within easy access of the Pennsylvania Turnpike.

Penn-Lincoln Parkway

A great highway construction program is now going forward in Pittsburgh and Allegheny County, as part of a comprehensive improvement effort designed to make Pittsburgh more attractive as a place to live and more efficient economically.

The outstanding project is the Penn-Lincoln Parkway, — Pennsylvania's first non-toll limited access highway. This 27-mile expressway which will link with the Pennsylvania Turnpike via routes #22 and #30 and will carry these routes into and through the city and county is well along in construction. A project of the Pennsylvania State Department of Highways, the Parkway is one of the best examples of the united community action and teamwork animating Pittsburgh today. The funds for this multi-million dollar expressway are being provided on a matching basis by the State and Federal governments, with $5 million contribution from Allegheny County and $1 million from the City of Pittsburgh.

Construction contracts in excess of $35 million on the Parkway East have already been awarded and work is moving ahead on schedule. The Parkway East is approximately 9½ miles in length and will reduce travelling time from 25 minutes to 12 minutes. Work on the completion of the first 8 miles of the Parkway East is now in progress.

One of the most spectacular projects on the Parkway East is the 4,225 foot Squirrel Hill Tunnel through one of the city's most heavily populated residential areas.

During July and August 1950 the State Highway Department awarded contracts for the construction of 9½ miles of the Penn-Lincoln Parkway West from the Banksville Traffic Circle to a point near the new Greater Pittsburgh Airport where the Parkway West connects with the section of the Parkway completed by Allegheny County. At this point the Parkway West also makes a connection with the Airport Parkway, leading directly to the Greater Pittsburgh Airport.

The cost of the Penn-Lincoln Parkway is estimated at $80 million, an amount exceeding the cost of the western extension of the Turnpike. While only 27 miles in length as compared with the 67 mile length of the Turnpike West, the costs of building an expressway through a heavily-congested urban area where the terrain is rugged, are great. The Pennsylvania Turnpike together with the Penn-Lincoln Parkway will make downtown Pittsburgh one of the nation's most accessible cities.

Approaching Pittsburgh via Pennsylvania Turnpike and the Penn-Lincoln Parkway

Automobiles and trucks with destinations in the city-county area willl have direct access to the Pittsburgh community via Pennsylvania Turnpike and the Penn-Lincoln Parkway.

The most direct route to downtown Pittsburgh will be via Monroeville Interchange on the Turnpike West. From this Interchange automobiles and trucks will use 5 miles of Route #22—William Penn Highway — to Churchill Borough where the Parkway East originates. Here the Parkway East with its free-flowing traffic will carry vehicles directly to downtown Pittsburgh or via its six interchanges to various points in the eastern sections of the community.

Traffic with destinations in the western parts of the community will continue through the city on the Parkway West, which will also have six interchanges for easy access to these neighborhoods.

Pittsburgh will also be easily accessible via the Turnpike's Irwin Interchange, and approaching the Penn-Lincoln Parkway at the Ardmore Boulevard Interchange.

Route #28 will connect directly with the Turnpike West at the Allegheny Valley Interchange at Oakmont. The improvement of Route #28 is a project high on the State's program for western Pennsylvania.

Route #8 will connect with the western extension of the Turnpike via Butler Valley Interchange near Wildwood, and Route #19 via the Turnpike's Perry Highway Interchange at Warrendale. In this connection the State plans to extend McKnight Road from its present terminus in North Park to Route #19, making the North Pittsburgh area easily accessible to the superhighway.

Motor Freight Study

A motor freight transportation study conducted by the Allegheny Conference on Community Development and covering operations of the motor freight trucking industry in Pittsburgh and Allegheny County showed the far-reaching effect the western extension of the Turnpike will have upon traffic conditions in Pittsburgh.

The study based on a questionnaire survey of the major trucking firms indicated that 80 percent would use the Turnpike West in bypassing Pittsburgh. Questionnaire returns were exceptionally high and represented the most important operators in the field.

There is no question that the extension of the Turnpike West will have a marked effect in diverting through heavy truck traffic from city and suburban streets.

Point State Park

One of America's most historic landmarks is the Point area at the confluence of the three rivers at the very heart of Pittsburgh. It was here that the destiny of this country was decided. The victory of the English over the French in 1759 fixed the future of America as part of the English speaking family of nations.

Today the State of Pennsylvania is embarked on a program to create a 36-acre Point Park, which will commemorate the historic significance of this area in American history.

Point Park is destined to become one of the great tourist attractions in this country.

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"History Repeats"

(Continued From Page 112)

the present Turnpike were largely financed through the use of private capital. During these 200 years we have seen the rise of the Railroads as a competitive Agent to highway transportation from the beginning in 1834 to the present time. Now the Railroads are fighting desperately to meet the competition of highway transportation. At the time of the construction of the first Turnpike it was impossible for the newly born Commonwealth of Pennsylvania to provide for the necessary highways through construction by use of public funds. Today we see a return to that situation. I believe every one will agree that sufficient money would not have been available in the Treasury of the Commonwealth of Pennsylvania to construct the Turnpike which is now being dedicated.

The Turnpike of today will not face the possibility of competition from another field of transportation such as the development of the Railroad. Transportation over highway is increasing rather than diminishing. The only other medium available for transportation is by way of the air ways. When the time arrives that transportation by air will furnish serious competition for travelling by highways, all turnpikes will have become obsolete. It is, therefore, reasonable to assume that history is repeating itself by the construction of roads through private investment. With the completion of the Turnpike across the State, and the proper connections to the Turnpike now under construction in New Jersey it will be only a matter of time until Turnpike construction will be forced on States to the west of Pennsylvania. As the old Turnpike helped in the development of the Country West of Lancaster so future Turnpikes will furnish transportation over highways with greater comfort and speed in the years to come.

Transportation has been the back bone of the life of men down through the ages. It is one of the fundamentals of living in peace or War.

Increased transportation facilities have been responsible for the development of these United States. No where in the world has the development of highway construction attained the perfection that we have in this country. Whereas history has recorded the construction of highways for nearly five thousands years, we have in this country within the last 250 years attained a supremacy which may never be equalled in total miles of improved highways within any one country.

It is a far cry from the Old Kitanning Trail winding its way through the forests and undeveloped lands of two centuries ago to the section of the Pennsylvania Turnpike now being dedicated.

Many changes have taken place since the Indian roamed the area now occupied by the Cities and Boroughs between Lancaster and Philadelphia. One geographical feature however remains unchanged — the distance between Philadelphia and Lancaster. The development of transportation facilities has made it possible for us to cover in hours, distances that required our forefathers several days. Construction of the Turnpike required the building of a highway over the same distance as the Old Philadelphia-Lancaster Turnpike; and in the final analysis we have only done, in accordance with modern standards, that which our forefathers did according to the best standards available to them in their era. We are providing within the fenced right of way of the Pennsylvania Turnpike, a highway which serves the same purpose as that of the one constructed over 200 years ago — the best available transportation between Lancaster and Philadelphia. The main difference is in the method of providing for the transportation in terms of comfort, safety and speed. History has repeated.

"The Progress Statistics --- Pennsylvania Turnpike"

(Continued From Page 60)

is scheduled for completion — October 1, 1950 — in spite of the many obstacles which confront contractors, mainly, excessive wet weather during Spring and early Summer, Railroad Strike, Steel Strike, Cement Strike and numerous other handicaps which are naturally encountered in a project of this magnitude. The October 1, 1950 completion here mentioned is three (3) months prior to our original proposed scheduled completion, January 1, 1951.

In maintaining records of progress, a uniform system applicable to both the Philadelphia Extension and Western Extension has been effected in such a way that, while holding to certain basic rules of order, the system was kept flexible enough to eliminate delays caused by overemphasis on system.

First of all, statistics were accumulated in order that information relative to current progress would be available to all interested parties on a current basis. Such information applied in different degrees and under different emphasis to both the Construction Contractors and the Design Engineers. Information required from the field was kept simple and concise throughout the job to insure immediate availability. Accumulation of such data was maintained in simple and readily understandable forms to eliminate delays required in making intricate compilations. Such action maintained a close control on Contract items as awarded, and made currently available information necessary to effect changes in quantities or items due to field conditions encountered after construction started. By following this procedure the Contractor was always assured that the Contract upon which he was working was in a current condition and that all items of extra work were being processed on a current basis. This also insured current payments to the Contractor for work done, and it is anticipated, will eliminate many questions which so often arise when the time comes to work up data to support final payment.

By maintaining close control over information relative to progress, it was only a short step to the maintenance of records covering payments to Contractor for current work accomplished. It was the desire of the Commission to promote a system of prompt payments to Contractors, since it was their feeling that prompt payments were an important part of such a fast moving program. The forms used were again kept as simple as possible so that a quick but thorough check could be made with rapid cross reference to physical progress as reported by the field.

All contracts specified a date by which payment for the work accomplished in the previous month would be paid. While this date varied between the 15th and 25th of the month, the ease with which these forms could be checked usually resulted in all payments being accomplished by the fifteenth (15th) of the month.

For such final payments as have been processed to date, the close control of quantities during the active construction period, has resulted in a clearer and more rapid agreement between contractors and Commission personnel regarding the adjustments required. Upon reaching such an agreement on final quanitites, such information is directed to the statistical section where all such quantities are accumulated to the contract and required adjustments noted, after which all papers required by the contractor to cover final payment are drawn up as fully as possible in the Commission offices and submitted to the contractor for completion and execution. Payment is started immediately upon return of these papers.

Of course, keeping records of primary objects entails maintenance of records on parallel subjects necessary to round out the entire picture. Figures are maintained, in total form, as to man hour and employment data on contractors. Employment data is also maintained on Pennsylvania Turnpike Field Force with regard to placement on jobs and cost involved.

As a support to contract control it is also a necessary duty of this office to collect data necessary to support approval of subcontractors. This data, which includes Performance Record and Technical Qualifications of the proposed subcontractor, involves also all other pertinent data required in the award of a contract.

Since construction funds were an important consideration of this project, a monthly budget status report was made up with emphasis on construction commitments. This status report was submitted monthly in order that information would be available at stated intervals.

Other items such as claims and extra bills were all handled from the standpoint of their application to the construction work involved and where applicable, the availability of information to support payment. In the operation of the statistical section, an endeavor was made to keep controls in operation, not for the sake of controls, but to insure that such controls would facilitate and support the construction contractors and design engineers in the accomplishment of their tasks.

The regular session of Legislature in the year 1941, by an Act of Assembly, provided for the extension of the Turnpike from Irwin, westwardly, to a point on the Ohio or West Virginia State line, to be known as the Western Extension.

The Turnpike Commission did in June, 1949, adopt the alignment and authorized immediate construction of the Western Extension from the present terminus at Irwin to the Pennsylvania border, East of Petersburg, Ohio. Financing for this portion of the project was completed with the sale of $77,500,000.00 of bonds in September, 1949, under Trust Indenture of June 1, 1948, providing for the refinancing of the operating road and the financing of the Philadelphia Extension. This created a total indebtedness of $211,500,000.00 for the entire construction of the Turnpike System from the Ohio State line to King of Prussia.

It is felt that mention should be made here of the work involved covering the Western Extension of the Pennsylvania Turnpike, which is scheduled for completion in October of next year. This extension of the Turnpike extends from Irwin to the Pennsylvania border, East of Petersburg, Ohio, this being a distance of approximately 67 miles, which comprises twenty-three (23) construction contracts, totalling approximately $44,875,-192.00 with eighteen (18) contracts of grading, drainage, structures and paving averaging 3 to 5 miles in length, also two (2) major river crossings, Allegheny and Beaver River Bridges, three (3) Viaducts, Willow Run, Plumb and Brush Creeks, fifty (50) L.R. Crossings, thirty-one (31) T. R. crossings, six (6) Interchange Structures and six (6) Railroad Crossings, seventy-six (76) Stream and Drainage Structures. In summary, there are five (5) major structurers, ninety-three (93) Grade Separation Structures and seventy-six (76) Stream and Drainage Structures, or a total of one hundred seventy-four (174) in the entire project.

All contracts covering this work to date have been awarded and are under construction. The entire Western Extension is scheduled for completion by October, 1951.

The completion of the Western Extension will furnish an express type highway, practically across the Commonwealth of Pennsylvania, which will possess numerous advantages over other parallel routes. The Turnpike System will make possible 327 miles of travel with greater safety, greater ease and comfort of driving, considerable saving in time and fuel and with complete elimination of congestion and interference not possible on other routes.

The magnitude of the work involved in the twenty-three (23) contracts on the

(Continued on Page 134)

Political Triumphs or Engineering Triumphs

(Continued from Page 52)

be elected governor.

He would launch a building program that would make possible decent housing and eare for our insane.

He would clean up and prevent further pollution of our beautiful streams.

He would extend the Pennsylvania Turnpike eastward to Philadelphia, and westward to the Ohio line.

And on the basis of his pledges to the people of the Commonwealth, Jim Duff, the Allegheny County politician became the Honorable James H. Duff, Governor of the Sovereign State of Pennsylvania.

Even before he took his oath of office he had made clear to the members of the Pennsylvania Turnpike Commission what he expeeted of them.

The Philadelphia Extension will be completed and in operation before Governor Duff moves out of the gubernatorial office in Harrisburg.

By that time and by reason of his many accomplishments maybe the members of the Fourth Estate will have promoted him from "politician" to "statesman".

So with all due regard for the skill of the professions, the engineers, the lawyers, and the bankers, the Pennsylvania Turnpike is actually the achievement of politicians. It is the handiwork of two great men, the triumph of two politicians who became statesmen.

I might say in conclusion, even though it might be considered as anti-climax, that in the twelve year history of the Pennsylvania Turnpike Commission, there have been few members who could not and undoubtedly would not want to be placed in the category of "politicians".

I'm not going to go down the list and name these commissioners. It is sufficient to say that, not in spite of their political background, but because of it, the Pennsylvania Turnpike is regarded the world over as a well and efficiently managed institution.

Much of the success of this Commission is due to the untiring work of our Chairman, Tom Evans. Daily he is called upon to meet with men in all walks of life, to make decisions and resolve differences.

And Tom Evans would be the first to admit that it was his training in the school of Schuylkill County politics that makes it possible for him to carry on as Chairman of the Pennsylvania Turnpike Commission.

So the next time you read about some great awe-inspiring construction project, look for the common cliche "An Engineering Triumph", then pause to wonder who might have been the "politician" that made this engineering triumph possible.

Pittsburgh Hails The Pennsylvania Turnpike

(Continued from Page 118)

The Pennsylvania Turnpike and the Penn-Lincoln Parkway will make Point Park easily accessible to the American tourist.

The Future

The Pennsylvania Turnpike at Pittsburgh's door is a great asset to this city and every community in western Pennsylvania.

New industries and businesses as well as present manufacturers are finding locations in the Pittsburgh district of strategic importance in reaching the markets of the northeast and midwest via the Turnpike.

It will also make more accessible the vast recreational opportunities Pennsylvania offers its citizens. The Turnpike's convenience to the motoring public cannot be overestimated.

With the completion of the western extension of the Turnpike in 1951, Pittsburgh's location as "The Gateway to the West" will assume even greater meaning.

The Turnpike's Part in The Renaissance of Highway Commerce

(Continued from Page 83)

was "in the biggest expansion ever conceived in the history of the state . . . Because of your turnout from the Pennsylvania Turnpike, you will have connections with the ports of Pittsburgh and Philadelphia on the greatest first-line, no stop, low grade highway in the world. The possibilities of inviting industry to your community is enhanced by the nearness of this community to the Turnpike. Every community near the Turnpike will be thus affected."

In an editorial commenting on the Governor's address, the Harrisburg Evening News stated, "The Governor indulged in no verbal taffy in addressing his audience. He did better. He showed how the borough's relation to the Turnpike will open up transportation routes which can mean much to the community. Dillsburg for years was at the 'end of the rail line'. It is different now. Highways have replaced railroads. Dillsburg is on a great north-south trunk line. The Turnpike will put it in close touch with another."

This picture of future greatness brought about through truck transportation over an adequate highway was seconded by a Dillsburg banker, Mr. J. C. Stauffer, in a letter to the editor of the Evening News. He wrote, "Highways, and the business they bring, are indeed the key to a prosperous future for this and many other communities in Pennsylvania. And the vehicle which will bring in the raw materials and take to market the finished product of our industry is the same vehicle which has been our economic lifeline for a good many years . . . the motor truck."

This recognition by the Governor of the state, a prominent businessman and a city newspaper of the importance of an adequate road to the success of the community is an indication of how other towns along the Turnpike have and will benefit by this fine highway.

This is the Turnpike's part in the renaissance of highway commerce.

Other communities in Pennsylvania, whether located near the Turnpike or not, can share in this renaissance of highway commerce. By seeing to it that their own highway needs are fully realized by their local and state highway authorities, citizens of all communities will insure the benefits of a second economy through prosperous industry and trade.

Through the Pennsylvania Motor Truck Association, the trucking industry in Pennsylvania has long been a supporter of an adequate highway system. William A. Sutherland, then manager of the Association, was one of the original founders and promoters of the original Turnpike. Realizing the increasing importance of commercial highway use, he and Victor Lecoq, of the State Planning Commission, discussed the idea of using the old South Penn Railroad right-of-way for the construction of a toll road. The two men presented their idea to the Hon. Cliff S. Patterson, then member of the State House of Representatives from Monongahela.

Because the Highway Department did not have funds available for a survey of the proposed route, Sutherland, Lecoq and Patterson began a personal investigation to see what information was available. With the cooperation of David Fernsler of the Associated Press, who had done some research on the old South Penn Railroad, much valuable engineering data was obtained. At the same time, the concept of a superhighway was widely publicized throughout the state by Sutherland, using the name and facilities of the truck association.

Patterson introduced a resolution into the House of Representatives in 1935 and a commission was appointed to investigate the feasibility of the project. Lacking state funds, the commission succeeded in obtaining financing from the Works Progress Administration and made the initial survey of the route and the possible traffic volume. On March 9, 1937, as a result of the survey, Patterson introduced a bill into the State Legislature calling for construction of the highway.

This bill, signed May 21, 1937 by Governor George H. Earle, was the start in making use of what was described by one of the South Penn Railroad engineers as ". . . the best route ever devised, or ever can be devised, between the Ohio River and the Atlantic Ocean." The eastern extension of the Turnpike makes this engineer's idea a reality.

More recent activity by the Association in the interests of adequate highways includes cooperation with the State Highway Planning Commission. In addition to information supplied to be used as the basis of investigation, representatives of the Association and the respective county chapters gave evidence at the Planning Commission hearings in Philadelphia, Pittsburgh and Harrisburg.

The Pennsylvania Motor Truck Association intends a lasting and active interest in the construction and maintenance of an adequate highway system that will fully serve the consumers in peacetime and the nation in time of national emergency.

As a part of the national defense in time of war, the Turnpike provides a through route from the industrial might of western Pennsylvania and Ohio to the eastern seaboard ports of Philadelphia, New York and Baltimore. It is a highly strategic link in the line of supply for our soldiers, sailors, marines and airmen, no matter where they are. Trucks will carry over the Turnpike the materials that mean success and victory for our armed forces.

Trucks from all parts of the United States are the largest single users of this wide, spacious artery of commerce. It is easy to understand that the benefits of this facility would not be available to the consumers of Pennsylvania without the large contribution made by trucks to its financial stability. As of May 31, 1950, the close of the fiscal year, trucks had paid over half the total revenue of $36,361,-276.03 collected since the Turnpike opened, but constituted only an average of 20.4% of the total vehicular traffic.

The steadily increasing contribution of trucks to Turnpike income is readily seen in the following table. The high total for the first five years shows the importance of the highway in national defense, and the total in the last five years indicates the growing amount of service rendered by trucks.

TRUCK OPERATION on the PENNSYLVANIA TURNPIKE

Fiscal Year Ending	Truck Tolls Paid (1)	Percent. Vehicular Revenue	1Percent. Vehicular Revenue
5/31/41 (2)	$ 544.	38.4%	11.7%
5/31/42	1,153.	40.1	12.7
5/31/43	1,312.	69.8	28.7
5/31/44	1,235.	72.4	31.9
5/31/45	1,294.	71.2	30.3
5/31/46	1,369.	50.9	18.1
5/31/47 (3)	1,989.	52.3	18.4
5/31/48	2,644.	54.6	18.8
5/31/49	3,478.5	58.4	20.6
5/31/50	4,511.	62.9	23.3

(1) In thousands of dollars.
(2) Not a full year, begins October 1, 1940.
(3) After January 1, 1947, R and S registration trucks are included with automobiles, are not included in these figures.

Source: Turnpike Commission reports.

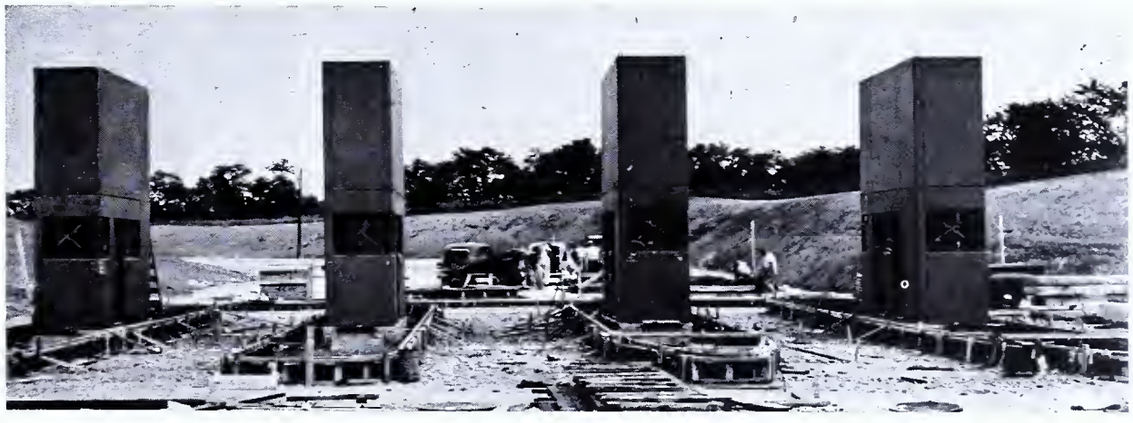
Trucking in Pennsylvania salutes the construction men, the engineers, the machinery operators and the many others who labored many long, hard hours in building this eastern extension of Pennsylvania's fine superhighway. It has a deep and abiding respect for men who can construct adequate highways so that trucks can increase their serviceability to consumers, not only in Pennsylvania but everywhere. It offers a special fraternal pat on the back to the truck operators and truck drivers who sooner or later carried all the materials used in construction of this superhighway of commerce.

Rigid Frame Bridge —one of the eight structures built by Brown, Davis and White on Section 21-A-2 of the Philadelphia Extension.

Our compliments and best wishes to the Pennsylvania Turnpike Commission on the completion of the Philadelphia Extension. We take considerable pride in having had a part in this great road building project.

Brown, Davis & White - - - Lebanon, Penna.

Toll Booths and Utility Buildings on Philadelphia Extension



Toll Booths and Plaza being erected on Harrisburg-West Shore Interchange

Erected by

B. D. & W., INC. **CARLISLE, PA.**

Traffic and Earnings . .

(Continued from Page 106)

of equivalent through trips on the Philadelphia Extension will be 2,363,500, which is approximately 25 percent of the total traffic moving through the district to be served by this new facility. The resulting toll revenue has been estimated at $3,780,000.

For the Western Extension, for the year 1952, we have estimated that the number of equivalent through trips will be 2,871,820, or approximately 25 percent of the total traffic moving through the district to be served by this new facility. This is estimated to produce a gross toll revenue of $3,304,000.

During the year 1952, the total toll revenue for the entire Turnpike System has been estimated at $16,554,000. In addition, there will be revenue from other sources, such as sales of gasoline, etc., amounting to $924,000, or a total gross revenue from all sources of $17,478,000.

It is clearly apparent that the Pennsylvania Turnpike System provides a modern highway facility for a substantial volume of traffic moving in an east-west direction across the State of Pennsylvania. The financing of this important highway facility has been made possible through a system of tolls, whereby the user pays for the use of the facility.

The Financial Success of The Pennsylvania Turnpike

(Continued from Page 88)

It should be understood at this point that on November 17, 1943, the Commission by resolution determined that an additional $3,000,000 bonds would be required to provide final payment in full of the entire cost of the project. $1,500,000 of this amount was offered and immediately sold in December 1943 to private bankers which explains the increase of the bonded indebtedness from $40,800,000 to $42,300,000. It is significant to note that the offering of bonds made in December of 1943 following 3 years operating experience produced a bid of 1.3 points over par or a premium of $19,500, whereas the original offering required a discount of about 8 points under par in order to attract a market for them.

In response to the public invitation for proposals to purchase $46,000,000 in refunding bonds, sealed competitive bids were received from 3 investment banking houses of which, that of, Drexel and Co., of Philadelphia and New York was accepted as it offered not only the lowest interest rate to the Commission but the highest premium as well; the interest rate bid being 2½% with a premium of $432,354. Reduction in interest rate from 3 3/4% on $42,300,000 bonds to 2½% on $46,000,000 bonds affected a saving in interest requirements of close to a half million dollars each year. This saving, augmented by substantial increases in revenue as was currently indicated and anticipated throughout the succeeding years, will, in all probability, provide for complete amortization of the debt in much shorter time than scheduled. The sustained increase in traffic can be gathered from the fact that during the 3½ years of the war period the daily average had fallen to 3,080 vehicles; nevertheless in the two years following the war this average rose to 6,200 per day and for the 30 months from June 1, 1947 to November 30, 1949, the average use of the Turnpike was 10,100 vehicles per day. During the calendar year 1949 the Turnpike was used by 3,848,788 vehicles producing a vehicular revenue of $7,049,543.81 or a daily average of 10,545 vehicles and a daily revenue average of $19,313.82. The traffic engineers had predicted that during the year 1949 the Turnpike would be used by 2,310,000 vehicles producing a revenue of $4,770,000. The most recent report for the fiscal year beginning June 1, 1949 and ending May 31, 1950 discloses that the Turnpike was used by 3,962,671 vehicles with a fare revenue of $7,713,896.53. The daily average was 10,857 vehicles and the daily average fare revenue was $21,133.96. The traffic engineers had estimated for the tenth year of operation the traffic would be 2,340,000 with a fare revenue of $4,832,000. The growth of traffic on the Turnpike, ranging from an average daily vehicle use of 5,300 vehicles in the period immediately following the war to a daily average use of 10,857 vehicles in the fiscal period ended shows the growing popularity of the Turnpike and the recognition of its advantages to all types of motor travel. Its attractiveness to the motoring public can be most forcefully realized by the fact that over 2 billion of miles of travel have been made on it since its opening in 1940.

Material Procurement . . . . .

(Continued from Page 87)

grade and stabilized shoulders were established in each of the Districts. This was in the form of a small laboratory in which gradation, plasticity index, compaction and optimum moisture could be determined. It was also realized that these items were more or less a new departure in the construction which would require close cooperation with the contractor as local materials were involved to a considerable extent.

In this short discourse an attempt has been made to describe the background and the reasons for various operations and specifications representative of a cross section of the procurement and control problem without confusing details.

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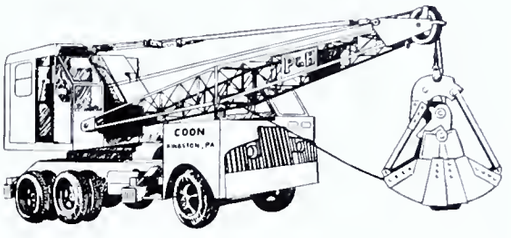

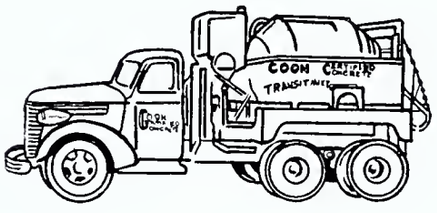

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Bolton G. Coon 1866-1931
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The Turnpike Crosses The Susquehanna

(Continued from Page 116)

All piers that carry the girder spans have a single base and all river piers have a single shaft below Elevation 302.5 and twin shafts above that elevation. Piers 1 and 2 on land are similar. There is no longitudinal batter on the piers. The expansion piers have a uniform thickness of 6'-6" from the top to the base and the fixed piers which carry additional longitudinal forces from the superstructure are uniformly 8'-6" thick. Dimensions of all fixed pier bases are 18' x 68' and those of the expansion piers are 11' or 12' x 65'. All bases are uniformly 5'-0" thick and they are placed a minimum distance of 2'-6" into sound rock. The bases are reinforced and were placed in the dry.

Streamlining of the pier shafts is essential for hydraulic reasons. On the upstream end an elliptical-shaped nose consisting of a 3-centered curve has been used. The middle radius at the nose is 1'-3". The upstream face of the pier is vertical; the downstream face is semicircular in shape and is battered 3/4 in. per foot for aesthetic reasons. Since the upstream and downstream faces of each twin shaft above Elevation 302.5 are unsymmetrical and are curved in the manner described for the pier as a whole, it was necessary to batter the downstream sides of both the separate shafts and the single shaft below to prevent a "lopsided" appearance. The repetitive use of the forms was obtained by using a fixed dimension at the base and, in effect, cutting off about 3 inches per pier for the difference in height. This resulted in a slightly variable dimension at the top for the downstream half of each of the twin shafts.

The top surface of the pier between the twin shafts below Elevation 302.5 is steeply sloped to reduce the accumulation of debris during extremely high floods.

The eight beam-span piers have a uniform thickness of shaft of 3'-6" which is solid to the height necessary to provide a collision wall adjacent to the railroad tracks. Above this the construction is open, consisting of six columns joined by a top strut. The end shafts are rounded on the outside to resemble the river piers.

Construction was given to stone facing for the piers for durability and resistance to ice abrasion and freezing and thawing at the water line. Examination of the piers of the four bridges at Harrisburg showed that such abrasion as had occurred is well distributed throughout the full band between high and low water marks and that it is not concentrated within narrow limits at any particular water stage. It was concluded that the additional protection afforded by stone would not justify the half-million dollars which it would cost.

The examination of the two bridges at Harrisburg which have concrete piers also indicated that the abrasion or spalling that has occurred to date began and continued downward from the outer edge of the bottom pour at a construction joint. This may be due in part to laitance but it suggested the importance of reducing the number of construction joints in the shafts and of protecting the outer edges of the joints where necessary to use them. This was done by placing a trapazoidal-shaped horizontal rustication at each joint. This rustication is 3½" wide at the outer face, 1" wide at the back and 1¼" deep. The construction joint is located at the bottom of the inner face of the rustication and the edge is protected from abrasion by ice. A limited amount of similar rustication was added near the tops of the twin shafts to improve the appearance.

The loads on the piers resulting from large ice floes were taken into account in the design. The piers are capable of resisting a differential head of water of more than 20 feet if ice floes should be jammed between two or more of the piers and arched across the opening, forming a dam. Such ice jams would, of course, result in longitudinal forces as well as transverse and these were also included in the design.

Consideration was also given to the use of curved bottom flanges on the girders. Although they resulted in some reduction in the quantity of steel (about 2.6%), the increased cost of fabrication more than offset the saving in weight. In a shorter, continuous bridge, one of five spans for example, curved flange girders usually improve the appearance. The Susquehanna Bridge is so long, however, that the large number of repetitions of the same span tends to nullify the usual advantages of curved bottom flanges.

The only financial concession to aesthetics other than the few items previously mentioned, is the adoption of a full length floor panel (maximum length 27'-3") for the railing panel in order to eliminate intermediate posts requiring additional framing not otherwise needed. This resulted in some fairly heavy sections.

The rail consists of four lines of horizontal channels. The two intermediate rails are 8" channels @ 13.75#; the bottom rail is an 8" ship channel @ 22.8#. These rails are supported by the top rail at the third points by a hanger consisting of two 1" round bars in short lengths welded between the channels. The top rails thus carries all of the vertical live and dead load as well as its share of the horizontal load. It is a built channel consisting of two 8 x 4 x 5/8 in. angles with the 8" legs vertical. The toes of the two 4" legs meeting on the center line are continuously welded and the assembly is stiffened at intervals by welded plate diaphragms. It is interesting to note that the machine weld between the toes of the 4" legs was so uniform and smooth that little if any grinding of the weld was required for appearance. The posts consist of two 8" ship channels @ 22.8# placed back to back, with an 8 x 3/8 in. fill between them above the riveted connection to the web plate of the floor brackets to which they are fastened at each panel point.

The construction is an interesting story beyond the scope of this article. The concern of the designers and specification writers over the cofferdams and the effects of flood stages during construction was wasted. The summer and fall of 1949 proved to be one of the dryest summers on record and the water stage was unusually low. The piers in each crossing were built inside of earth and rock dikes placed up and downstream from the bridge and bulkheaded at every second or third pier. Enough of each channel was left open to provide for the flow of the river using open trestle construction when necessary to provide access to the construction. The speed with which the river piers were built during this period is good evidence of the quality of the contractor's organization and skill in handling large jobs in record time.

The bridge was designed for the Pennsylvania Turnpike Commission by Parsons, Brinckerhoff, Hall & Macdonald, Engineers, of New York, with the writer as the partner in charge. Mr. George Vaccaro was in charge of the substructure design and Mr. Richard S. M. Lee was in charge of the design of the superstructure. The plans and specifications were subject to the approval of Mr. R. B. Stone, Chief Engineer of the Commission.

Booth and Flinn of Pittsburgh constructed the bridge under a combined sub and superstructure contract. The Bethlehem Steel Co. fabricated and erected the steel superstructure under a subcontract. Curiously, only the railings were fabricated at the Steelton plant in whose back-yard the bridge is located.

4 Miles....

of the

Philadelphia Extension

on the

Pennsylvania

Turnpike System

Contract 203, Sec. 23 - C

Paved by

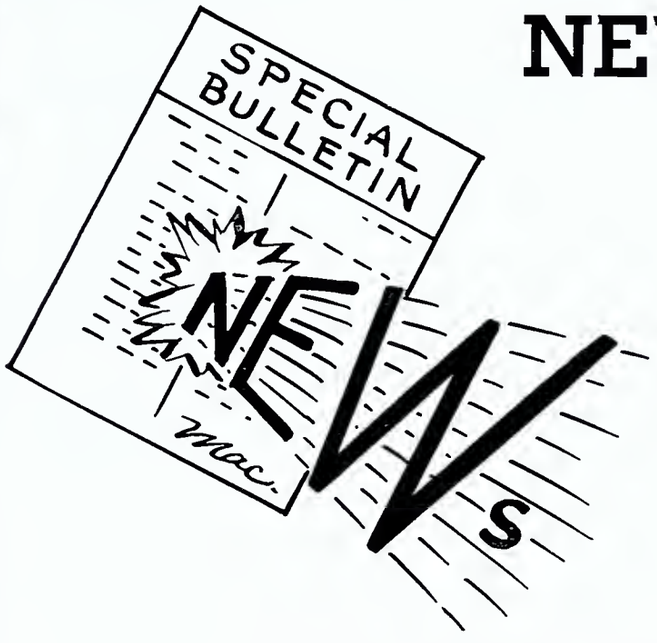
James Julian

We commend the Pennsylvania Turnpike Commission and wish them success in the future development of this great highway system.

JAMES JULIAN

General Contractor

405 SOUTH DUPONT ROAD — ELSMERE, DELAWARE



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THIS NUMBER of "Highway Builder" is a rather spectacular achievement of Associated Pennsylvania Constructors to mark the opening of the world's greatest highway—the Pennsylvania Turnpike System's Philadelphia Extension.

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Yes, Associated Pennsylvania Constructors is constantly working on many problems of fundamental interest to every contractor, such as:

Combating attempts to build highways and other public works by day-labor methods.

Sponsoring and supporting state and national legislation designed to benefit the industry, and opposing measures that are detrimental to contractors and allied interests.

Resisting undue encroachment of organized labor.

Opposing publication of misleading data.

Representing the industry on committees of business organizations and other trade groups.

Assisting public officials in securing adequate funds for building highways.

Guarding against encroachment of highway and heavy construction by employees of local, state and federal governments.

Providing opportunities through meetings and conferences for unified industry-wide action.

Encouraging cooperation between allied groups for the good of the entire heavy construction industry.

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200

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Ventilation and Control of Carbon Monoxide In Penna. Turnpike Tunnel

(Continued from Page 109)

carbon monoxide content at approximately 1 part in 10,000. Now, on the matter of detection of carbon monoxide, we have a centrifugal pump which continuously draws the air samples through a 3/8-inch copper tube running from a niche in the tunnel wall itself to the analyzer contained in the portal building and through the scrubbing system. On the Pennsylvania Turnpike we use carbon monoxide analyzers as made and furnished by the Mine Safety Appliance Company. The carbon monoxide content is measured by oxidizing the carbon monoxide to carbon dioxide; and by measuring the oxygen required or the heat generated for such oxidation we have a measure of the carbon monoxide content of the original sample. This carbon monoxide content is continuously recorded day and night throughout the year on an Esterline Chart.

Calibration: Periodically our carbon monoxide analyzers are calibrated, which is done by first making sure that a fresh-air sample shows a reading of zero and, second, that the introduction of unknown amount of carbon monoxide sufficient to produce 4 parts in 10,000 when introduced into this fresh-air sample will show a reading of 4 parts in 10,000, on the analyzer.

Control: As pointed out before, all fans in the ventilating system for all tunnels are similar in size and design, and in the original installation these fans were set to operate at varying speeds so as to produce a maximum ventilation of from 190,000 cubic feet per minute each at one inch pressure in Blue Mountain Tunnel to over 300,000 cubic feet per minute each at four inches pressure in Ray's Hill Tunnel.

Our method of operation is one in which the control panel in the portal building from which the fans are started and stopped contains, among other equipment, a series of lights which are hooked into the system between the analyzer and the Esterline Chart, which are set up so that when the carbon monoxide content of the sample of tunnel air reaches 1 part in 10,000 a white light is lighted on the control panel; when the carbon monoxide reaches 2 parts in 10,000 an amber light is lighted; and when the carbon monoxide content reaches 4 parts in 10,000 a red light is lighted and a bell rings. The operation of the fans themselves is manually controlled as to the starting and changing from one speed to another and the stopping thereof. Our customary procedure is to turn on one fan at quarter speed with the lighting of the white light at the time the carbon monoxide content has reached 1 part in 10,000, and if said ventilation is sufficient to hold said content at about 1 part in 10,000 that fan continues to operate. However, if the carbon monoxide content continues to increase and before it reaches 2 parts in 10,000 additional fans are turned on at quarter speed or the speed is increased to half speed as may be necessary to keep the carbon monoxide at approximately 1 part in 10,000.

Entirely unknown to the motorist, this operation is continuing 24 hours of every day and 365 days of every year in order to keep the air in the Pennsylvania Turnpike tunnels far more than safe for human occupancy. The tunnel ventilation installed on the Pennsylvania Turnpike is of such magnitude that when all fans in all tunnels are operating at maximum speed with maximum ventilation, they are moving 6,140,000 cubic feet of air per minute or are really ventilating the tunnels with 13,763.5 tons of air every hour.

Turnpike Fare Schedule

PENNSYLVANIA TURNPIKE COMMISSION

PENNSYLVANIA TURNPIKE
FARE SCHEDULE

CLASS 2

VEHICLE TYPE: PASSENGER AUTOMOBILE
TAXI-CAB
AMBULANCE
HEARSE

VEHICLE TYPE: LIGHT TRUCK-PENNA. LICENSE CLASS: R, S
VEHICLES REGISTERED OUTSIDE OF PENNA SHALL BE CLASSIFIED IN ACCORDANCE WITH THE SIZE OF TIRES

FULL LENGTH FARE $3.25

NAME OF INTERCHANGE	GATEWAY	BEAVER VALLEY	PERRY HIGHWAY	BUTLER VALLEY	ALLEGHENY VALLEY	PITTSBURGH	IRWIN	NEW STANTON	DONEGAL	SOMERSET	BEDFORD	BREEZEWOOD	FORT LITTLETON	WILLOW HILL	BLUE MOUNTAIN	CARLISLE	GETTYSBURG PIKE	HARRISBURG - WEST SHORE	HARRISBURG - EAST	LEBANON - LANCASTER	READING	MORGANTOWN	DOWNINGTOWN
BEAVER VALLEY	25																						
PERRY HIGHWAY	30	.20																					
BUTLER VALLEY	45	.30	20																				
ALLEGHENY VALLEY	.55	40	25	15																			
PITTSBURGH	65	50	.35	.25	15																		
IRWIN	75	60	45	.35	25	.15																	
NEW STANTON	.85	.70	55	45	35	.25	10																
DONEGAL	1.00	85	.70	55	45	40	.25	15															
SOMERSET	1.15	1.00	.85	.70	60	55	40	35	.20														
BEDFORD	1.50	1.35	1.20	1.05	95	90	75	70	55	.35													
BREEZEWOOD	1.65	1.50	1.35	1.20	1.10	1.05	.90	.85	.70	.50	15												
FORT LITTLETON	1.85	1.70	1.55	1.40	1.30	1.25	1.10	1.05	.90	70	35	20											
WILLOW HILL	1.95	1.80	1.65	1.50	1.40	1.35	1.20	1.15	1.00	80	50	35	15										
BLUE MOUNTAIN	2.05	1.90	1.75	1.60	1.50	1.45	1.30	1.25	1.10	90	60	45	25	10									
CARLISLE	2.25	2.10	1.95	1.80	1.70	1.65	1.50	1.45	1.30	1.15	85	70	50	35	.25								
GETTYSBURG PIKE	2.35	2.20	2.05	1.90	1.80	1.75	1.60	1.55	1.40	1.25	95	80	.60	45	.35	15							
HARRISBURG - WEST SHORE	2.45	2.30	2.15	2.00	1.90	1.85	1.70	1.65	1.50	1.35	1.05	90	70	.55	45	.20	10						
HARRISBURG - EAST	2.55	2.40	2.25	2.10	2.00	1.95	1.80	1.75	1.60	1.45	1.15	1.00	80	.65	55	30	.15	10					
LEBANON - LANCASTER	2.70	2.55	2.40	2.25	2.15	2.10	1.95	1.90	1.75	1.60	1.30	1.15	.95	.80	.70	.50	.35	.30	.25				
READING	2.85	2.70	2.55	2.40	2.30	2.25	2.10	2.05	1.90	1.75	1.45	1.30	1.10	95	85	.70	.55	50	40	25			
MORGANTOWN	2.95	2.80	2.65	2.50	2.40	2.35	2.20	2.15	2.00	1.85	1.55	1.40	1.20	1.05	.95	.85	.70	.65	55	.35	.20		
DOWNINGTOWN	3.10	2.95	2.80	2.65	2.55	2.50	2.35	2.30	2.15	2.00	1.70	1.55	1.35	1.20	1.10	1.00	85	.80	.70	.50	.30	20	
VALLEY FORGE	3.25	3.10	2.95	2.80	2.70	2.65	2.50	2.45	2.30	2.15	1.85	1.70	1.50	1.35	1.25	1.20	1.05	1.00	.90	.70	.50	40	.25

The Progress Statistics—Pennsylvania Turnpike

(Continued from Page 120)

Western Extension can readily be ascertained from a few of the items covered by these contracts, namely: Class 1 Excavation, 14,829.762 cu. yd. Class 2 Excavation, 379,353 cu. yd., Special Subgrade, 3,316,839 sq. yd., 9" Reinforced Concrete Pavement, 1,851,427 sq. yd., Class A Concrete, 36,352 cu. yd., and Class B concrete, 122,279 cu. yd.

As can be imagined, the undertaking of these additional extensions must have loomed in all its giganttesque when first approached by the five-man Pennsylvania Turnpike Commission in 1948. However, the Commission under the able leadership of Thomas J. Evans, its Chairman, went courageously ahead to raise the $211,500,000.00 needed to construct the additional extensions. The fine spirit of cooperation that exists between the Commission, its employees and contractors has been the major factor in the progress of the Turnpike construction. This same spirit was carried throughout the different Departments within the Commission, and as a result each person was a member of a great team.

Engineering Problems of The Turnpike

(Continued from Page 63)

cordance with our standards. Specifications provided for the use of air-entraining cement in all structural concrete. Within the scope of our engineering policy, modifications and changes were possible depending upon conditions peculiar to bridges. Some of these are readily apparent, others cannot be seen.

The center mall, or the ten-foot grassed area between the two 24-foot lanes of paving, is designed with a depressed or concave cross-section. This area which will carry surface drainage, combined with the subsurface drainage of the special subgrade introduced complex problems to our engineers and designers. In some instances pipe culverts serve a dual purpose by carrying surface as well as subsurface water.

Much more might be written relating to our many interesting engineering problems including traffic interchanges, radio communication, etc, which are described in other articles in this issue.

The solution of these related problems was affected by the joint and wholehearted effort of the Commission and all those affiliated with these projects.

The effect will be felt and made known by the motoring public for whom the Turnpike extensions were built.

The Newly Designed Delineators or Reflectors

(Continued from Page 71)

"A Light That Never Fails," which title tells the Scotchlite story complete in a few words.

The Scotchlite delineators on the Philadelphia Extension of the Pennsylvania Turnpike, as stated above, are placed 200 feet apart on the shoulders and in the centers along the tangents, and every 100 feet on the curves. They are also carefully placed on posts so that the center of each delineator will be 42" above the nearest edge of concrete pavement. Engineers have decided that at this level above the concrete pavement, the motorist sitting behind his steering wheel gets the maximum amount of reflection. Therefore, a great deal of care is taken to have all the delineators exactly the proper and identical height above the concrete pavements. The delineators will be mounted on 1¼" channel posts. These posts are driven into the ground 2 feet. Along the shoulders the delineators and posts are placed 10 feet away from the edge of the concrete pavement except where guard rail is in place, then the delineators and posts are directly in back of the guard rail, which is 8 feet away from the pavement. The delineators are placed on the shoulders of the Turnpike on the posts so

as to face the motorist and in the center strip two delineators are placed on each post — back to back — so that each motorist going in opposite directions has two delineator to guide him on his way.

The furnishing of the most modern and efficient delineators is another instance of the planning done by the Turnpike Commission and their engineers as a means of greater safety to the motorist using the World's Greatest and Safest Highway.

"To anybody who has experienced the ease and convenience of driving over the Pennsylvania Turnpike, this, undoubtedly, is an old story. But for the uninitiated motorist, the Pennsylvania Turnpike is a dream drive to be wished for, a motoring joy that can be consummated only by the actual experience of driving over it."

* * * * * * *

"The Pennsylvania Turnpike gives motorists and truckers all-weather passage through the Appalachian Mountains over a route of low grades to the City of Philadelphia. It frees Pennsylvania once and for all of the barriers that is mountains always have imposed between the Atlantic Seaboard and the Middle West."

* * * * * * *

Road Will Be Free by 1988

"Raising of new funds for the extensions has constantly changed the maturity date on the bonds—pushing back the date of release of the road to the state. The freedom date is now set for 1988, but the maturities may be advanced by any number of years if traffic continues ahead of estimates and operation costs do not increase proportionately.

Thus the Pennsylvania Turnpike becomes the 'yardstick' for all superhighway building of the future. Its construction involves every known principle of engineering skill and its financial program is the product of the best brains in the business."

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Affiliated with American Road Builders' Association

The One Organization in Pennsylvania, Devoting its Entire Efforts Towards Serving those Interested in Highway and Airport Construction and Development.

VALUE OF TRADE ASSOCIATIONS

"The trade association today presents the soundest, organized approach in a democracy to the solution of group problems in industry. In spite of its weakness, it offers, orderly approach to the solution of trade or industry . . .

It is difficult sometimes for the individual to merge his selfish need for self-preservation in the larger good of preserving the group; but it is increasingly evident that unless the preservation of the group is accepted as the basis of self-preservation, there will be no such thing as self-preservation in business

—The ATAE News

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Beaver River Bridge

(Continued from Page 81)

span units. This procedure would have required very little falsework and made it possible to take full advantage of the symmetry of the bridge in duplication of shop work. Due again, however, to the difficulties of access to the site and to the construction schedule for the adjacent Turnpike, the contractor has elected to erect the structure with equipment starting at the east abutment and proceeding in one direction to completion at the west abutment. The procedure which has been adopted will require only a few falsework bents, including only one for the main span over the river. This, however, will be a very high bent and would not have been needed had the other procedure been possible.

The contract for the substructure was awarded by the Turnpike Commission to the Dravo Corporation on February 20, 1950, and for the superstructure to the American Bridge Company on March 28, 1950. The bridge is scheduled for completion by late fall of 1951. Its construction cost will be about $2,200,000. Designs and contract plans were prepared in the office of the consultant, who also is responsible for approval of all shop drawings and advisory services during construction. Detailed supervision is under the general direction of the District Engineer for the Turnpike Commission.

Today some of the natural beauty of the Beaver River Bridge site is lost by reason of the necessary construction operations. Time will heal the construction scars, and the user of the Turnpike will enjoy the opportunity of a fine view of the Beaver valley made accessible to him as he crosses the new bridge

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The Special Design Problems of The Turnpike

(Continued from Page 59)

seems to affect drivers on the long uninterrupted tour across the Turnpike, and because the Philadelphia Access Highway, just ahead, will be posted for a 50-miles-per-hour speed limit.

The interchange with Pennsylvania Route 100 was so designed, at the request of the Pennsylvania Department of Highways, that the state could at any time in the future complete the remaining ramps, construct the grade separation bridge under T. R. 100, and purchase all of the required right-of-way.

The terrain adjacent to Pennsylvania Route 72 was found to be unfavorable for an interchange with desirable ramp gradients, and considerable study was necessary before an acceptable location was selected. The connection to Route 72 was made at grade with acceleration and de-

(Continued on Page 144)

Pennsylvania Turnpike System Interchanges

The official names of the Interchanges on the 100-mile Philadelphia Extension from Middlesex to King of Prussia and on the 67-mile Western Extension from the Ohio border to the present western terminal at Irwin are as follows:

Philadelphia Extension (From West to East)

At the junction of U. S. Route #11 ..... CARLISLE
(instead of the present name of "Middlesex").
At the junction of U. S.
Route #15 ..... GETTYSBURG PIKE
At the junction of Pa. Route #24 (near present
U. S. Route #111) ..... HARRISBURG-WEST SHORE
At the junction of 22019 Legislative Route
(near U. S. Route #230—Highspire and
Steelton) ..... HARRISBURG-EAST
At the junction of Pa.
Route #72 ..... LEBANON-LANCASTER
At the junction of Pa. Route #222 ..... READING
At the junction of U. S. Route #122 .... MORGANTOWN
At the junction of Pa. Route #100 .... DOWNINGTOWN
At the junction of U. S. Route #202 .... VALLEY FORGE

Western Extension (From West to East)

At the Ohio border ..... GATEWAY
At the junction of Pa. Route #18 ..... BEAVER VALLEY
At the junction of U. S. Route #19 .... PERRY HIGHWAY
At the junction of Pa. Route #8 ..... BUTLER VALLEY
At the junction of Pa.
Route #28 ..... ALLEGHENY VALLEY
At the junction of U. S. Route #22 ..... PITTSBURGH

The names of the Interchanges on the present Turnpike have NOT been changed and are as follows:

From West to East:

IRWIN
NEW STANTON
DONEGAL
SOMERSET
BEDFORD
BREEZEWOOD
Ft. LITTLETON
WILLOW HILL
BLUE MOUNTAIN

For the 327 miles of the completed Pennsylvania Turnpike System, there will be twenty-four Interchanges. All are conveniently located at the junction of principal routes, affording easy access for motorists to reach recreational and historical points of interest, as well as industrial centers from one end of the State to the other.

Performance of Original Section, Sets Type on Turnpike Projects

(Continued from Page 53)

is necessary if the people who pay for the road are to receive proper return on their expenditures.

To most persons, including even some closely identified with highway matters, this is a theoretical or "paper" earning at best. But it is a very real earning and highways must be so constructed that they will serve the purposes for which they are intended at the lowest possible cost per vehicle using them.

After ten years of service, approximately half of it under adverse conditions, the orginal 160-mile Pennsylvania Turnpike has much to offer the highway engineer as well as prospective builders of similar highways. Experience gained here has been of invaluable benefit to the Pennsylvania Turnpike Commission and the Commission's engineers who are responsible for the extensions to span the Commonwealth. Certainly the experience here should be of interest to others who are planning modern highway developments to meet increasing traffic demands.

Ten years ago I was privileged to write an article in the issue of Highway Builder featuring the dedication of the original 160-mile Turnpike. In this article the step-by-step development of the design of this expressway was recounted. Then I stated: "The type of pavement was also changed so that all four lanes were concrete. All parties involved realized that this type of pavement showed a consistently lower annual maintenance cost".

Further, I wrote, "Before deciding on the thickness of the pavement slab, Turnpike engineers in charge of design carefully studied the data on anticipated weights and volume of traffic. They didn't want to specify slab thickness greater than was needed because this would result in higher cost. Neither did they want to specify an insufficient thickness because this might result in slab failures, interrupted traffic and excessive annual maintenance cost."

Ten years of rugged service show how sound their reasoning was.

The tremendous progress that has made the Turnpike System both necessary and real is without precedent. But this progress was matched with an almost daring determination to solve the problem.

A scant century ago both in Europe and America travel was no swifter than it was in Ancient Rome 2,200 years before. Today it is commonplace to see licenses indicating cars two and three thousand miles from home, yet only a few days away.

About 50 years ago certain dreamers began putting wheels on their dreams, and a new industry was born. So quickly did this new mode of transportation catch popular fancy that in the decade prior to 1920 motor vehicle registrations were increasing from 23 to 57 percent per year. World War I gave sharp impetus to the production of trucks, many of which were military vehicles. A Nation, under pressure of automotive progress, became road conscious.

But automobiles were appearing much too fast for the road builder and the automobile was said to be ahead of the highway.

It was this condition that made the Pennsylvania Turnpike possible. A better crossing over the Appalachian Mountains was needed, and another dream began to crystallize—and grow until today we see in reality a trans-State heavy-duty traffic artery.

The planners of this highway system were faced with a complex problem. Since the project has to be, like any other well-planned road, self-liquidating, the Turnpike has to offer many extras in comfort, speed and safety. And these extras will have to remain such during the anticipated life of the road. In other words, the Turnpike planners had to go ahead of the motor vehicle further than the motor vehicle had been ahead of existing routes.

That they have done so needs no recounting here. Analysis of the orginal Turnpike traffic will show that prior to Pearl Harbor average monthly traffic was slightly more than 205,000 vehicles. During the war, of course, traffic volume dropped. Present monthly average traffic amounts to well over 330,000 vehicles — full proof that the motoring public will seek high rated roads.

During the past four fiscal years passenger car traffic on the Turnpike has increased 43 percent and truck traffic 107 percent. The economic value of truck cargoes in the past fiscal year has been estimated at well over $11,500,000,000.

In all these years, with a high daily traffic of more than 29,600 vehicles recorded on July 1, 1950, the capacity of this link has not been approached, and maintenance costs have not been out of

(Continued on Page 144)

Typical Rigid Frame Concrete Overpass.....One of many such structures that eliminate the hazards of cross traffic throughout the length of the Turnpike System.

View of the Philadelphia Extension of the Pennsylvania Turnpike as it swings toward the Susquehanna River.

Turnpike and Highway Construction in Western Pennsylvania

(Continued from Page 91)

ways or the construction of new roads.

The remainder of the 67 mile western extension has been let and is scheduled for completion in October, 1951. It includes contracts let to the following companies: Rochez Brothers, Pgh.; Dinardo, Inc., Pgh.; Dravo Corporation, Pgh.; Hunkin-Conkey Construction Company, Cleveland, Ohio; Ralph M. Myers Contracting Corporation, Salem, Indiana; Patterson Construction Company, Monongahela, Pa.; Harrison Construction Company, Pgh.; Holmes Construction Company, Wooster, Ohio; Frank Mashuda Company, Milwaukee, Wisconsin; L. G. DeFelice & Son, Inc., North Haven, Connecticut; D. W. Winkelman Company, Inc., Syracuse, New York; and A. J. Baltes, Inc., Norwalk, Ohio.

Well over sixteen million cubic yards of excavation will be required on the Turnpike western extension along with over thirty million pounds of steel which will go into the construction of the two bridges crossing the Allegheny and Beaver Rivers, viaducts, overpasses and interchanges. The unusually rainy winter did much to hamper those contractors who were awarded jobs during those months, but much of the lost time has been made up and most of the contracts are running ahead of schedule at the present time. Contracts have average approximately two miles in length with several of the contractors securing as high as three or four separate contracts. The largest single contract in dollar volume to be let was that to the L. G. DeFelice Company totalling $7,108,419.

(Continued on Page 152)

Top Left: The Ferguson & Edmondson Company's substructure for the viaduct over Frush Creek is shown here during pouring operations. Low bid on this was $354,150.

Bottom Left: With the aid of three cranes a 28½ ton girder is being placed by Latrobe Road Construction, Inc., at the tie-in between the new western extension and the existing Turnpike near Irwin.

Top Right: A portion of the Ralph Myers Contracting Corporation's job on the site of the new interchange of the Turnpike extension with Route 22.

Second Right: The Pavia Company is well along on the grading of their 3 mile section. Shown here is the erection of the batch plant in preparation for pouring operations.

Third Right: The Ralph Myers Contracting Corporation loads Euclids on part of their 4 mile stretch in Westmoreland County which was awarded for the low bid of $3,068,107. The interchange with Route 22 is part of this same contract.

Bottom: The D. W. Winkelman Company, Inc. at work on one of the numerous cuts required on their 3.3 mile contract in Westmoreland County.

Radio Communication Primary Safety Factor on Pennsylvania Turnpike

(Continued from Page 62)

burg would be picked up by the station on Blue Mountain and automatically relayed to Tuscarora Mountain, Sideling Hill, Rays Hill, Allegheny Mountain, and Laurel Hill. At Blue Mountain, Sideling Hill, Allegheny Mountain, and Laurel Hill local coverage stations would repeat this transmission to interchanges, mobile units, maintenance buildings, etc. in the vicinity of each. Thus, all fixed and mobile stations along the length of the Turnpike would hear the transmission. The patrol unit being called would reply and its transmission would be picked up at the nearest relay station and passed along the entire network in similar fashion.

The communications system on the existing Turnpike has performed its required functions very satisfactorily for a period of ten years and has proved invaluable on many occasions in the smooth and efficient operation of the Turnpike.

With the formulation of plans for the extension of the Turnpike to Valley Forge in the east and westward to the Pennsylvania-Ohio State line, the question of communications again became one of prime importance. During the period of operation of the system on the existing Turnpike, changes in rules and regulations of the Federal Communications Commission made it necessary to establish the relaying functions of the radio system on a different band of frequencies. Even this was a temporary measure and a further shift to much higher frequencies was indicated.

Accordingly, Raymond Rosen Engineering Products, Inc. undertook the task of field surveys and engineering studies to develop a unified radio system to cover the entire Pennsylvania Turnpike which when the entensions to the original highway are completed, will extend 327 miles across Pennsylvania.

Extensive tests were carried on, using newly developed RCA equipment operating in the 952-960 mc portion of the spectrum recently made available by the Federal Communications Commission. This type equipment offers many advantages for relaying purposes over the lower frequency system previously utilized. Virtually no noise is encountered at these frequencies, and with highly directional antenna systems it is possible to obtain very high antenna gains. In addition, the design of this equipment provides for multi-channel operation.

Following the same basic principles as the original system, the new network will utilize mountain top locations for relay stations and for associated transmitters and receivers for local area coverage. This makes it possible to use certain facilities in the center section of the Turnpike which were provided in the original system ten years ago.

The new radio communications system will provide a general voice channel, as was the case in the original network. In addition, a teleprinter circuit will be provided between Valley Forge (eastern Turnpike terminus), the Harrisburg Turnpike Office, Everett Maintenance Headquarters, tunnel portal buildings, and Gateway (Pennsylvania-Ohio Border). This will make possible the transmission of printed messages between these locations at the same time that the general voice circuit is in use. In fact, additional voice and teleprinter circuits may be added to the system in the future, if such expansion is desired.

In order to provide maximum efficiency of operation, the general voice circuit will be divided at Everett into east and west sections. Simultaneous conversations may be carried on in each section, thus effectively increasing the potential "on the air" time. However, should a message originating in one section be of interest to another section, it may be repeated at Everett, thus providing for complete coverage of the entire Turnpike.

The completion of this giant radio communication system, like the greater giant it was designed to protect and strengthen, is representative of similar systems that will one day interlace the whole country, assuring greater swiftness and greater safety in the fastest forward moving country in the world — America.

Our Part in the Philadelphia Extension

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greatest harmful element to state roads because it is the heavy trucks that do the greatest damage to our ordinary highways, which are not designed to carry them, as is the Turnpike. Also, it lessens the traffic hazards on other roads.

As Mr. Paul Troast, Chairman of the New Jersey Turnpike Authority has said, — we need the Toll Roads to help us catch up on the 40 billion dollars we are behind in our highway program.

The whole country-wide Turnpike program is fortunate because we had the situation in Pennsylvania simply made to order for a self-supporting toll road. The long, steep hills of central Pennsylvania were bugbears to every cross-state or cross-country trucking company. It was obvious that they would jump at the chance to save time and gasoline by following a low grade and far shorter route across the Alleghenies, and they did. It was a natural location for a profitable toll road. As in most things, Pennsylvania has been the leader in this progressive improvement to transportation. In canals, then railroads, and now turnpikes, Pennsylvania has led the way.

I'm for Toll Roads, for Turnpikes, and particularly for the Pennsylvania Turnpike and for its Chairman and Commissioners, — long may it, and they, live and prosper.

Keystone Automobile Club Hai's the Penna. Turnpike

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joying deluxe travel over the new. If he considers time and ease of travel important, he will pay the relatively small fee for this great boon to travel. Millions have already done so on the original Turnpike, and it is entirely reasonable to suppose that the entire Turnpike will be patronized to an extent that will permit the amortization of bonds and the incorporation of the superhighway into the free highway system within the life span of millions of motorists who contributed their tolls to this end.

In short, Keystone hails the project and its early completion with cheers and congratulates Governor Duff and the Turnpike Commissioners — all and sundry — for the greatest highway project ever conceived and completed in America.

Construction Equipment Distributor and the Turnpike

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Distributor are working together for the benefit of the Contractor. Only through acceptance in the field, can the Manufacturers and Construction Equipment Distributors survive. Through this cooperation and competition, improvements are made and costs lowered.

The Pennsylvania Contractors are fortunate in having behind them so many fine organizations engaged in selling and distributing construction equipment in Pennsylvania. Region 3 of the Associated Equipment Distributors includes all the Distributors in the Commonwealth of Pennsylvania, and in the experience of the writer, no State can boast of better sales and service organizations than we have in Region 3. The construction of this great Turnpike is an example to the world as to what can be done through the competitive system of free enterprise.

It was with great pride that the Construction Equipment Distributors in the Commonwealth of Pennsylvania, in cooperation with the Manufacturers they represent, served the Contractors in performing this magnificent job in such record time.

We all take our hats off to the State Government and those Officials who had the vision and foresight to proceed with this huge undertaking. We know it will stand out as a beacon to all people, truly an example of progress under the American Way of Life for years to come.

The Design of Turnpike Interchanges

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site to coincide with long range future development of the free highway should be chosen. Immediately subsequent to the selection of the general site for the interchange, the time or point has been reached where traffic patterns in the form of anticipated traffic turning movements enter into the design, thereby governing general ramp shape, turning radii, lane numbers and widths. Contour maps with intervals suitable for the terrain, if not already available, should be secured for the entire area in which the interchange will be located. Thence preliminary design sketches, in all four quadrants if all are possibilities, are made in the form of transparent overlays for the contour map. These overlays may also be superimposed upon contour maps developed by photogrammetry of the location and compared for desirability, based on analyses of safety, appearance, conformity to the terrain and of course economy, as determined by construction cost, plus land acquisition and property damage. While cost should not be the primary determinate, it usually has the controlling or veto power to eliminate a particular design from further consideration.

When comparison and study of the preliminary sketches has established the most desirable design, the final detailed design is initiated. From single line drawing of lanes and over or underpasses, combined with a profile establishing the approximate grades that may be achieved, the skeletal design progresses from 200′ per inch scale of the preliminary overlays to the 50′ per inch scale detail drawing of the final design.

The question of over or underpassing is usually determined in the preliminary design stage as part of the conformity to terrain conditions. In the final design these overpasses and underpasses resolve themselves on the basis of span, width, height and structural economics into the specific deck plate girder, through plate girder, concrete T-beam, rigid frame concrete, or three-span continuous I-beam bridge, whichever best suits all considerations.

The next step is the design of ramps. The design speed is established, minimum radii chosen and pavement width selected. Actual grades are established which must provide for the transition of decelerated traffic slowly and smoothly from the turnpike into the toll booth area and from there accelerate and merge into the major highway, or the reverse of this from the free highway into the turnpike. Next follow details of pavement, expansion joint location for concrete paving, curbs, divisors, transition widths and lengths of toll areas, et cetera.

Calculations for the geometrics of alignment are made, using and establishing coordinates for control points. A base line is surveyed and monumented, then the center lines are staked and cross sections taken in the field. The basic templates for grading are applied to the cross sections and then, as the final picture begins to emerge, are varied for consideration of drainage, safety, appearance and earthwork balance. Landscaping must be kept in mind with slopes flat enough that will bear seeding and retard overturning of vehicles that may get off the paved roadway.

The final detailed drawings will carry thereon all data relative to coordinates, alignment distances, curves, superelevation rates, grades, slope limits and detailed list of items of construction.

Special problems arise with each interchange and they must be considered and satisfactorily resolved in addition to the usual design conditions that are encountered. For instance, in the case of

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Performance of Original Section Sets Type On Turnpike Projects

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line with expectations.

In other words, the orginal Turnpike is earning its own way just as it was designed to do.

When, in the course of events, time came to consider extending the Turnpike to Philadelphia on the East and the Ohio border on the West, it was natural to look to the performance record of the mountain section.

The 160-mile Turnpike from Irwin (22 miles from Pittsburgh) to Middlesex (not quite so far from Harrisburg) proved most of the basic questions raised. People will use the best road they can. The attractions of extra speed, safety and comfort of such a highway were clearly proved. Highways can be designed ahead of the automobile. Economic and military values were demonstrated. Need was not doubted.

When the original Turnpike was designed the choice of concrete as a paving material was no experiment. Already throughout Pennsylvania there were examples of hundreds of miles of concrete pavement that had withstood long years of hard service—many miles of these still are carrying volumes of traffic never expected when they were built. Maintenance costs on this concrete were favorable and initial costs often were less for concrete than for other pavement of equal load-carrying capacity. Durability of concrete had been shown.

Performance records of the 160-mile Turnpike proved again concrete's superiority.

It was a natural sequence that the first extension to the Turnpike should be toward Philadelphia. It was just as natural that pavement type be continued.

The Western extension follows in normal pattern, providing a closer connection with Pittsburgh and swinging northwesterly toward the industrial centers of Ohio and beyond.

While performance records on the original Turnpike are highly favorable, engineers have advanced their knowledge and experience in concrete design and construction. Every advantage was taken of this increased knowledge on both the Philadelphia and Western extensions, and there is justification for confidence in a better performance record on both extensions.

Air-entrained concrete was used to protect against the action of frost.

Expansion joint spacing was increased to 900 feet and changes were made in the distance between contraction joints.

Improvements were made in finishing techniques as well as in curing procedure.

Use was made of better knowledge of aggregate production and selection.

Wearing surfaces on bridges were made integral with the structural slab.

Special subbases were used in all cases where underlying soils had undesirable characteristics. This subbase material was extended through the shoulders and the surfaces of shoulders were stabilized.

Moisture density controls were used in the compaction of fills and selected material used in the tops of fills.

The thickness of the pavement slab was retained at nine inches.

Because of these improvements the service life of concrete pavements has been increasing year after year although traffic volumes and weights have been increasing at the same time. In other words, improvements in concrete pavement construction have more than kept up with the demands upon it.

So the "twin ribbons of concrete" that are the world's greatest expressway not only will tie together two of the Nation's most important areas, they also will serve as monument to those who guide the affairs of this State and to the American highway engineer.

The Special Design Problems of the Turnpike

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celeration lanes added to the present pavement as the anticipated volume of turning traffic would not interfere seriously with the through traffic on Route 72.

Soils encountered throughout the various sections which we were called upon to design were not a problem and slopes of 1:1.5 were found to be adequate. These slopes were flattened or the shoulders widened where necessary to provide for sight distance around curves.

Except for the specific problems noted above, the design of the Turnpike and facilities was according to accepted engineering practice for high-speed, multiple-lane, controlled-access highways.

The Pennsylvania Turnpike Commission, the Pennsylvania Department of Highways, the railroad companies, the township supervisors, the public utilities, and all of the other agencies are to be commended for their important part in expediting the work of planning the construction of the eastern extension of the Pennsylvania Turnpike.

The Design of Turnpike Interchanges

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the Carlisle Interchange, the special factors to be considered were the construction of an interchange to fit the existing terminus of the turnpike and the maintenance of traffic on it and on the state route during construction. The long flat shape of the interchange was projected into a ridge which furnished the excavation necessary to balance a predominately heavy embankment road section. In case of the Harrisburg—West Shore Interchange consideration in the design had to be given to adaptation to possible stage construction in conformity to the progress of construction on relocated U.S. Route 111. The Beaver Interchange at Homewood presented a special problem in adjusting for the best possible position between the Beaver River bridge to the East and the underpassing and paralleling of the Pennsylvania Railroad to the West.

An interchange is not merely designed — it is redesigned and redesigned until it is the best possible combination of the ideal and the practical, of a form functional but yet aesthetically pleasing, and with an ever watchful eye on the construction cost, especially since the Pennsylvania Turnpike is a self-supporting, self-liquidating toll highway.

The accompanying illustrations of typical turnpike interchanges represent our artist's conception of the ultimate appearance of the finished construction, and were developed from our final detailed interchange drawings. At the time of preparation, the official interchange name designations had not been chosen by the Pennsylvania Turnpike Commission.

The overall development of highway projects held by Capitol Engineering Corporation comes under my direction as Vice President and Chief Engineer of the firm. As Chief Highway Designer, Mr. Thomas C. Kennedy was responsible for the development of the geometrics and detailed highway design on these interchanges. Mr. Thomas G. Dean who is Chief Structural Designer on our staff, was directly responsible for the design development of all interchange bridge structures.

The Capitol Engineering Corporation, with headquaters at Dillsburg, Pennsylvania, enjoys a general engineering consultancy practice, as well as the practice of highway and turnpike engineering, presently covering most of the eastern portion of the United States.

The Proven Worth of The Super Highway

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State system is 5.3 per 100 million miles; and on the Boston Post Road, a heavily travelled road parallel to the Merritt Parkway, the fatality count is 11.2 per 100 million miles. During this same period on the Pentagon system, directly south of the District of Columbia, the death rate per 100 million miles is 1.5 whereas the death rate on the Virginia state highway system taken as a whole is 9 fatalities per 100 million miles. The Pennsylvania Turnpike has a record of fatalities of 2.9 per million miles, whereas throughout the State system the record is 5.6 fatalities per 100 million miles. The Arroya Secca has a fatality record of 3.5 per million miles, whereas fatalities for the California State system was 6.4. The national average for all highways is 7.4 per million vehicle miles.

Superhighways generally mean a limited access roadway with opposing lanes of traffic divided. This general feature alone may reduce fatalities over the old type undivided highway by a very high percentage. This was clearly demonstrated in New Jersey a few years ago when a four-lane highway was separated by introducing a medial strip. The record of fatalities after this was done dropped by 76 percent — clearly justifying this type of highway.

These are only a few of the proofs that the design of the superhighway has removed many of the hazards and built safety into the highway, at the same time affording the possibility of handling a larger volume of traffic at higher speeds and in less time.

It is impossible to appraise the value of human life in dollars but these examples afford proof that superhighways must be built to carry the ever-expanding highway transportation if our highway transportation is to be handled efficiently and safely.

Possibly there is no element that has a greater effect on our standard of living at the present time than the highway and highway transportation. In addition to the ever-increasing numbers of passenger cars, which use the highway both for pleasure and business, the highway is now a part of the transporting of over 50 percent of the tonnage of all commodities that make up the movement of goods in this country. This movement of goods has a direct bearing on the availability and price of commodities to the consumer.

The highway truck has become an important factor in our national economy and more and more is affecting the provision and cost of consumer goods to all the people of the nation. There are over 30,000 communities that depend entirely upon the highway for their existence. There are many cities that depend upon the highway for their milk supply, vegetables, meats and other innumerable items and more and more are becoming geared to depend upon the highway.

Since the beginning of the last war truck transportation has increased about 400 percent and is on the uptrend. The total number of motor vehicles now is close to 45 million and on the uptrend — about seven and one-half million of these vehicles are motor trucks. Wherever there cannot be a free flow of these vehicles then commerce and transportation is being impeded. The superhighway is the only device to date that points a way toward handling efficiently this increasing number of trucks and passenger cars.

The time has arrived when the two-lane designed roads, on at least 37,000 miles of our system, cannot possibly take care of the demands without unbearable congestion and a high rate of accidents. With either of these — congestion and accidents — there is an economic loss which affects our economy and in turn affects our standard of living. Therefore, in order to have a high standard of living it is necessary to have a free flow of vehicles. It does not mean all roads should be superhighways but when a road is overloaded then it should be redesigned and if conditions justify the ultimate road will be a superhighway that will adequately take care of the traffic.

During the late twenties our highway system was more nearly adequate for our vehicles than at any time before or since. There was a sizeable highway program during that period and the number of automobiles was less than 30 million. During the depression and the war there was a temporary reduction in the rate of vehicle registration. Our highway construction program dropped off nearly 75 percent and was never resumed until after the war. With the exception of this brief period in the reduction of registrations there has been a continuous increase in registrations until the maximum number of registered vehicles this year amount to approximately 45 million. So, due to the limited construction in highways in recent years the country finds itself with an increased traffic demand and a highway system hardly more adequate than when we had a little better than one-half the number of automobiles that we have today.

To build a sufficient number of two-lane highways to care for this increased highway transportation would be impractical but it is necessary to provide a highway facility by which the speed and safety can be increased so that a large number of vehicles in the congested areas can be taken care of in the least possible period.

In some instances this has been corrected by the superhighway. And, in those areas it has been plainly shown that when a superhighway is built a free flow of traffic results, with good progress in our economy and prosperity in the community.

If it were possible to truly evaluate the superhighway the figure would be so fantastic that it would be unbelievable. For instance, how much in dollars is a life worth? Thousands of lives are saved each year on the limited number of superhighways now in existance. How much is time worth? Hundreds of thousands of hours are saved every day by the motorists who travel our limited superhighways. How much is saved in the transportation of all types of commodities over superhighways where the flow of traffic is faster and more economical? Using the Pennsylvania Turnpike as an example of a modern superhighway, in May, 1950, 260,000 passenger cars and 100,000 trucks and buses used this highway in order to travel through Pennsylvania by the quickest, safest and most convenient way possible.

The popularity and practicability of the superhighway can be clearly demonstrated by the Pennsylvania Turnpike. At the time this road was being planned authoritative engineers in estimating traffic that would use the road set forth a ridiculously low figure. Since then more than ten times the number estimated have used the road. At first the trucking industry objected to the use of the road but after careful checks in cost of operation, and time saved, it was universally accepted by the trucking industry, as the most economic type of road to use. This in spite of the fact that tolls are charged for using the highway.

Theoretically it can be shown that toll roads are an expensive method of financing — yet on the Pennsylvania Turnpike it is evident that those using the highway are willing to pay for its use. This trend will continue until the bottle necks that cause congestion and accidents, and are limiting our national economy are corrected.

Regardless of the method of financing there is great need for a network of superhighways.

It has been generally estimated that from 20 to 50 billion dollars is needed to modernize our highways. This sounds like an excessive sum but if the cost of not having modernized roads could be correctly appraised it would be found that our inadequate roads would be more costly and expensive than a modern sys-

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Repeat Performance

Carlisle Interchange under construction

Cut for access road at Carlisle Interchange

We are proud to be represented by work on both the original Turnpike and the Philadelphia Extension. Ten years ago we constructed the cloverleaf in Westmoreland County. We have just completed the new interchange at Middlesex, including 1.67 miles of pavement

FRANK MASHUDA COMPANY

Milwaukee, Wisconsin

The Importance of a National Turnpike System

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mented need, our $1¾ billion rate looks decidedly anemic.

It is in the face of this grave highway crisis that the spotlight again falls squarely upon the Pennsylvania Turnpike Commission as it prepares to open its eastward extension. The "Pennsylvania Turnpike" is a byword across the nation, and millions of Americans from throughout the nation and from all walks of life have travelled all or portions of the 160-mile initial length since that stretch was opened just ten years ago, on October 1, 1940.

As remarkable as was the engineering on the first section of this great turnpike —with its modest grades and flat curves— this eastern extension to King of Prussia will be even more outstanding. Its maximum grade will be two per cent; its maximum curve three degrees. Later, when the 67-mile western extension to a point near the Ohio border is opened, motorists will have a 327-mile across-state super-highway that will continue to be a "show case" highway for the nation.

It was not so long ago, when the turnpike linking Irwin and Harrisburg was proposed, that scoffers estimated that to be a financial success, the turnpike would have to carry a daily average of over 3,000 vehicles, and their tones indicated clearly their doubt that such a figure ever could be attained. Some hazarded doubting estimates that not more than a scant third that number would make daily use of the new facility.

The Turnpike's record, in contrast, shows that despite war-reduced traffic volume during the days when tires and gasoline were rationed, the daily overall average vehicle count was 6,089. All told, between October 1, 1940, and December 31, 1949, 20,573,619 fare-paying vehicles used the highway and paid over $33 million for the privilege. In 1949 alone, 3,848,788 fare-paying vehicles, an average of 10,545 daily, used the highway and paid $7,049,543 in revenue.

These figures afford emphatic proof that people are willing to pay for good roads. In the case of their selection of the turnpike, they were willing to pay not only the regular state gasoline tax but also a premium of at least a cent-a-mile for access to the super-highway.

It took foresight, courage and initiative to launch the building of this great turnpike and see it through to completion. That launching came, moreover, in the depths of the great depression, when risk capital was anything but readily available and when prospects for a return from a business of any kind were extremely dim.

Foresight led the turnpike commission to realize that, at the highway construction rate we were then permitting, there was impending such a crisis on America's highways and that toll-free facilities would be so inadequate that such a turnpike was not only justifiable but about the only way the upcoming road emergency would be met.

Our highway situation today is such that only a major operation will save us from the strangulation which traffic congestion is causing. The flood of automobiles rolling from the assembly plants is inundating the country just as surely and just as devastatingly as though it were water that was preventing the speedy and orderly movement of people and goods.

Financing that operation is going to be costly. Every form of financing which may produce funds for more and better highways is of the greatest impartance in the face of today's emergency conditions. Revenue bond financing over the past 25 or 30 years has proven sound, fair to the public, attractive to the investor and of particular value to the user of facility, who pays directly for the superior service rendered. The full opportunities in the use of public revenue bond financing, in one form or another, in the securing of more and finer highway facilities, have only begun to be realized.

For there is no such thing as a "free" road, or bridge, or tunnel. The people pay for these facilities, one way or another—usually under the politician's concept of the fairest tax,—the tax which produces the most revenue with the least complaint.

Toll roads and bridges now in existence prove that the people are willing to pay for better facilities. They must be built only according to necessity—where they supplement so-called "free" highways which cannot be brought up to present-day standards and requirements under ordinary financing.

The Pennsylvania Turnpike has been the yardstick of the nation in the planning of far-sighted, self-liquidating public improvement projects. Spurred by the success of the Pennsylvania Turnpike, public officials have turned to turnpikes to provide express super-highways in Maine and New Hampshire, in Connecticut, in New Jersey, in Oklahoma, in Colorado, in West Virginia, in Ohio, in North Carolina and in many other states.

As yet, the turnpikes which are in existence, or are being built or are in planning stages, do not form a continuous route. But the pattern for what may very well become a cross-country facility is emerging clearly. Turnpikes now carry motorists from Portland, Maine, through Maine and New Hampshire, to the Massachusetts state line. At the Connecticut state line, either the Merritt or the Wilbur Cross Parkways are available to speed traffic across that state. Soon, the New Jersey Turnpike will pick up traffic leaving New York over the George Washington Bridge and carry it to a point near Camden, where the most direct route to the extended Pennsylvania Turnpike will be located, or on farther south to the new Delaware Memorial Bridge near Wilmington.

Traffic going onto the Pennsylvania Turnpike will be able to follow that route to the Ohio state line, speeding from Philadelphia to Harrisburg, past the snarled traffic of Pittsburgh, and on for 67 miles.

Ohio has a turnpike group working for a facility which would pick up traffic at the end of the Pennsylvania Turnpike and carry it across the state to the Indiana state line. From there it would be but a short trip into Chicago over turnpikes Indiana and Illinois have under consideration. It is not difficult, either, to look a little farther into the future and see a similar series of highways eventually fanning out to serve through-traffic throughout the country.

Financial interests are scanning turnpike possibilities closely. Writing in a recent issue of Atlantic Monthly, Sumner Slichter, nationally-known economist, had this to say:

"Finally, a major area of private investment can be opened up and substantial relief given to taxpayers by financing through-highways by tolls instead of taxes. The country badly needs a modern system of limited-access highways for through-traffic. Indeed, its present highway system may be roughly compared to the state of the railways at the time that Commodore Vanderbilt started to unite short lines into large systems giving through service. The provision of America with modern highways financed by tolls can open up enormous investment opportunities and at the same time lighten the load of the taxpayers."

Another visionary has come up with the proposal for six turnpikes to serve 39 states, with routes linking Boston and San Francisco, New York City and Miami, Cleveland, Ohio, and Jacksonville, Fla., International Falls, Minn., and Laredo, Tex., Jacksonville and San Diego, and San Diego and Puget Sound, Washington.

But that is all in the future. Our primary concern is today. Our primary interest at the moment is this great and growing ribbon of pavement that is being

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Bridge Engineering on The Philadelphia Extension of The Penna. Turnpike

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The Swatara Creek Bridge is a skewed structure in which six continuous girder spans are employed. The maximum span is 117 feet 6 inches long. The bridge crosses the creek on an angle of more than 50°. The adjoining Turnpike roadways are carried on relatively high embankments, which tend to constrict stream flow during flood periods. For this reason, it was necessary to provide additional channel width and to set all of the piers on the general line of stream flow. This resulted in a heavy skew of piers and abutments, and in an overall length of crossing of 611 feet. Silicon steel was used in the design of the four main girders.

The Yellow Breeches Creek Bridge is also a skewed structure. It is designed with continuous rolled-beams and a maximum span of 90 feet. The overall length of the bridge is 330 feet and the roadway, of reinforced concrete, is carried on ten lines of carbon steel beams.

The piers of all the bridges on the Philadelphia Extension are of reinforced concrete.

In line with the engineering policy of the Commission the designs of all structures were kept as plain and simple as possible in order to secure maximum overall economies, both in original cost and in future maintenance. This simplicity contributed greatly to the efficient and rapid completion of construction work in the field.

Steel And The Pennsylvania Turnpike

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been exercised to provide maximum visibility at all speeds.

There has been some change made in the sub-grade of the extension to provide for better drainage and eliminate "pumping", otherwise design is similar to that of the old Turnpike. The slab is 9 inches thick throughout for maximum strength.

The proposed tie-in with the now-building New Jersey Turnpike and with the Ohio Turnpike, which is still in the planning stage, will, with the Pennsylvania Turnpike, afford uninterrupted travel for trucks, busses and private automobiles east and west from New York for a total of nearly 1,000 miles.

Pennsylvania's Turnpike is the realization in steel and concrete of a dream that, as early as 1837, envisioned a great thoroughfare spanning the Commonwealth from east to west. Originally conceived as a railroad, it was implemented as a super-highway in 1937 when Gov. George H. Earle set up the Turnpike Commission to fix a suitable route, arrange for financing, and construct the highway. Its route is essentially that of the abandoned South Penn Railroad and much of the old roadbed is included into the highway, as are six of the nine formerly projected railroad tunnels.

Built at a cost of more than $70,000,000, or better than $461,000 per mile (including the cost of seven tunnels), the 160-mile original Turnpike has proved a money maker from the start, save for the years of World War II. Its net earnings for the fiscal year 1948-1949 topped $7,000,000. Eventual revenues, when the entire 327-mile highway is completed are expected to be better than $23,000,000 a year on a total investment of $239,000,000.

Most recent reports show that 65 per cent of the users of the original Turnpike are freight trucks, making it an important factor in the movement of goods and commodities. Turnpike Commission statisticians believe that the eastern extension will handle as many as 1500 freight truck movements each day into and out of Philadelphia and that the total movement of all types of vehicles over this segment of the Turnpike will be as high as 2,250,000.

Philadelphia's Highway Plans

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expressway worked out for 1950 and 1970. Here the long range comprehensive plan played a decisive role in estimating traffic volume.

The firms of Clarke, Rapuano and Holleran, and Hardesty and Hanover prepared the first phase plans; Modjeski and Masters being the consultants on the Schuylkill River bridges.

The plan as finally developed provides for a modified cloverleaf at the City Avenue overpass. The expressway proceeds through Fairmount Park to an interchange with the Roosevelt Boulevard Extension south of Falls Bridge. (See Illustration 2.) A new high level bridge across the Schuylkill River leads to a depressed section of Expressway adjacent to Abbottsford Avenue. After passing diagonally through Fernhill Park, the expressway overpasses the Reading Railroad tracks south of Wayne Junction, and then underpass 16th and 15th Streets, the Broad Street Subway, and Old York Road, before joining Roosevelt Boulevard. The route adjacent to Cayuga Street requires the removal of a strip of housing. (See Illustration 3.)

Except for the six-lane section between Wissahickon Avenue and the ramps to East River Drive, the Roosevelt Boulevard Extension will be a four-lane divided highway. Of the 36,000 vehicles that will use this section at its most heavily travelled point, only 3,000 vehicles will be through traffic. All of the remaining 33,000 vehicles will originate in or be destined for Philadelphia.

The Roosevelt Boulevard Extension will provide excellent access to the residential sections, industries, and Port Richmond in the Northeast, as well as an improved facility to the city center.

From the Roosevelt Boulevard interchange, the six-lane Schuylkill Expressway will proceed toward the city center high on the west bank of the Schuylkill River, through Fairmount Park. West River Drive, undisturbed for most of its length, will continue to serve as an alternate park drive route from Neill Drive to the Spring Garden Street Bridge.

Because of its high location, the expressway will provide a magnificent scenic entrance into downtown Philadelphia, the Schuylkill River winding in the foreground and the central city buildings rising in the distance. (See Illustration 4.) The northbound and southbound roadways, separated at most points, are planned to be different levels to provide an uninterrupted view.

A new six-lane bridge across the Schuylkill River is planned on the line of Vine Street, leading into a depressed section of expressway west of the six-lane tunnel under the Benjamin Franklin Parkway and Logan Circle, coming to grade at 16th Street. Here it joins the presently widened Vine Street leading to the Delaware River Bridge and the New Jersey Turnpike. This will provide a new six-lane facility for access to the city center, completely independent of the present parkway and East and West River Drives, relieving these overloaded arteries. (See Illustration 5.)

From the Vine Street interchange, the Expressway continues south as a divided highway along the west bank of the river. It underpasses projected Pennsylvania Boulevard with ramps to that facility and the 30th Street Station Plaza. It continues under Market, Chestnut, and Walnut Streets, and the South Street Bridge, to an interchange with the University Avenue Bridge. Here it connects with the new Vare Avenue-34th Street-26th Street highway leading to the airport, the Port of Philadelphia, and South Philadelphia industries. Plans for converting these highways to limited access highways are now being drawn.

Philadelphia is especially fortunate in that 94 per cent of the 10.7 miles of

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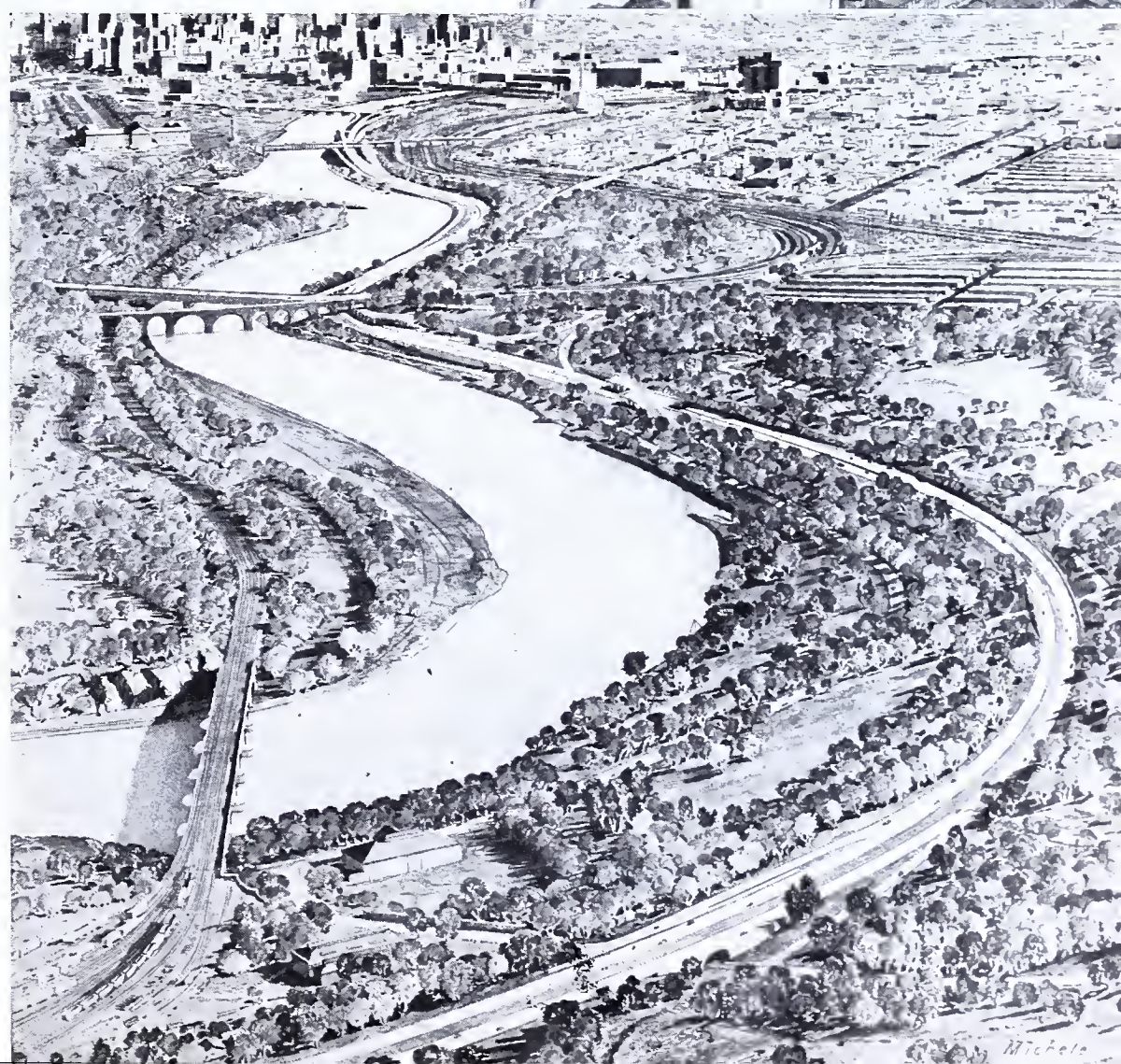
Upper Right: Artist's conception of Roosevelt extension of Schuylkill Expressway, looking east from 18th Street, showing underpasses and overpasses.
Below: Schuylkill Expressway looking toward dowtown Philadelphia.



The Importance of a National Turnpike System

(Continued from Page 148)

expanded to span Pennsylvania and serve highway transportation in the years to come as valuably as has the original 160 miles in its first 10 years. The record of achievement chalked up by the greatest of all super-highways in the past decade bodes well for the future. It is eloquent testimony that America's motoring millions want good highways, will pay for them, and intend to have them. If those who oppose toll roads are sincere in their desire to provide a national system of modern super-highways on a "free" basis, it is high time that they came forward with a financing program which is workable, practicable and acceptable to the public, and which will actually produce super-highways *now* and as surely and extensively as has become possible through the modern toll turnpike.

Philadelphia's Highway Plans

(Continued from Page 151)

expressway route is on open right-of-way, requiring no residential demolition. Only six per cent of the total route will necessitate displacement of families. The State Highway Department is expected to bear the major part of the estimated $77,000,000 cost of construction. The first phase engineering plans are now awaiting final approval and construction can begin as soon as final engineering plans are drawn and State Highway funds can be scheduled for the purpose.

When completed, the Schuylkill Expressway and the extensions connecting with the State Expressway to King of Prussia which leads to the Pennsylvania Turnpike, will provide Philadelphia with a needed internal circulation system and with excellent connections to the midwest industries and markets, vital to the full development of its economic potential.

The Proven Worth of The Super Highway

(Continued from Page 146)

tem of roads. We pay more for our poor roads than we do for good modern highways.

The relatively few examples of superhighways in this country have shown that congestion and high fatality rates can be corrected by the superhighway.

The need for an improved highway system has been recognized by Congress in its passage of a law to provide for an Interstate System of highways. These will all be of a superhighway type . . . a system that will provide a free flow of traffic and bring about efficiency and economy in our highway transportation thus increasing progress and prosperity of the Nation.

Congratulations to the people of Pennsylvania in the forward movement demonstrated by the building of the most modern of super-highways which will traverse the entire State of Pennsylvania from Philadelphia to the Ohio State Line with the completion of the Pennsylvania Turnpike System.

Turnpike And Highway Construction In Western Pennsylvania

(Continued from Page 141)

The completion of the Turnpike project together with the other improvements, either proposed or underway, will put Western Pennsylvania in a truly enviable position as far as its highway facilities are concerned.

Our Sincere Appreciaton to the Advertisers who helped make this Turnpike Dedication Issue possible.

Highway Builder

Turnpike Impetus To Growth and Prosperity of Pennsylvania's Commerce

(Continued from Page 39)

vania's inland cities which the Turnpike skirts.

This new trunk-line of commerce has become a reality at no cost to the Pennsylvania taxpayer. Not one cent of the gasoline tax or registration fees which Pennsylvania motorists pay has gone into acquiring the right of way or the construction of this 327-mile super-highway. In fact, even the tax on the gasoline sold along the Turnpike is used by the State for construction and maintenance of Pennsylvania's vast network of toll-free highways, none of the tax reverting to the Turnpike.

The cost of building the Turnpike has come entirely from revenue bonds issued by the Pennsylvania Turnpike Commission, and the interest and redemption charges of these bonds are financed solely through tolls collected on the Turnpike. By this method, only those who benefit from use of the Turnpike contribute to its cost, and approximately 50 per cent. of this cost is paid by out-of-state users.

The extended Turnpike's economic advantages will be immediate and many.

It will relieve overburdened highways of congestion and the weight of heavy traffic. It will lighten the traffic problems of many cities and towns now choked by truck convoys enroute to distant destinations. The Turnpike Commission has estimated that in 1951 the Philadelphia Extension will be used by more than 2,250,0000 vehicles for through trips. If this estimate is substantiated by actual use, it will represent approximately one fourth of the total traffic moving through the district served by the extension.

It will result in important savings in time and operation costs for shipments by truck. Traffic engineers estimate that in a haul from Pittsburgh to Philadelphia over the Turnpike, motor carriers will save from three to seven hours of driving per trip, depending upon the type of vehicle; that means the savings of one business day, in many cases. The Turnpike's easy grades and non-stop features will reduce fuel, tire and maintenance costs because there is less strain on transmission, brakes and engine. They also permit utilization of lower-powered trucks for the same payload. They also hold the possibility of lower insurance rates because of reduction of accidents due to sideswipes, head-on collisions, or cross-traffic.

It will enable Pennsylvania manufacturers to improve their competitive position in industry. It will broaden the market available for their product because it provides the route for fast haul and quick delivery at reduced trucking cost. Their customers, in turn, can operate with smaller inventories and more frequent turnover

The original segment of the Turnpike has been called "the engineering marvel of the generation." The completed Turnpike already has become the pattern for "the road of tomorrow." As the first trans-state super-highway it has become the foundation of a system of similar express highways, which are likely to become nationwide. New Jersey and Ohio already have acted to build trunk roads across their states and join them to the Pennsylvania Turnpike. Construction of similar roads already projected will enable traffic to follow toll super-highways from Maine to the Midwest with virtually no stops except for toll, food and fuel. Such an express highway system can be of major importance in the Nation's economic life and appears vital from the standpoint of national defense.

The completed Turnpike's importance to the growth and prosperity of Pennsylvania's commerce and industry will be enhanced in at least three aspects by inter-state connections to other super-highways.

One of these is the prospect of increased traffic through the Port of Philadelphia. Completion of the Turnpike and the Schuylkill Expressway to the Philadelphia waterfront should be the greatest boon to the Port since the movement of cargo by motor vehicle first became an important factor in the overland movement of freight. It will afford the best, fastest and safest route ever devised to link the heavy industries of Pittsburgh and the Ohio River basin with tidewater shipping at Philadelphia.

Governor Duff's insistence that the Turnpike be extended to the Ohio border opens the way for tremendous volumes of new freight shipments by truck toward Philadelphia and its port. States to the westward, starting with Ohio, are planning turnpikes to join ours, and these new

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Turnpike Impetus To Growth and Prosperity of Pennsylvania's Commerce

(Continued from Page 154)

sprouts from the Turnpike's western end will provide a fast and safe expressway for truck shipments from the big industries of Akron, Toledo, Detroit, and Chicago. Many of these shipments now move to seaboard through New York State; but with the completion of a protected, all-weather express route, free of congestion and cross-traffic, and characterized by greater safety, ease of driving, and speed, it is expected many will be routed through Pennsylvania — especially in the winter season. When a truck with a shipside destination reaches King of Prussia, it will be many miles nearer to the Port of Philadelphia than to any other harbor.

This direct route from the West almost to its piers will give the Port of Philadelphia an advantage it has not held since the Erie Canal was built.

Another aspect of tremendous importance to the development of Pennsylvania is that new industrial areas and new markets are virtually certain to grow along the route of the Turnpike. It touches or sweeps near many hamlets which in the past were off-route towns, hampered by the lack of swift transportation facilities. These communities, instead of being off the beaten track, will now be on a new "main line." These areas will be opened to industries by providing direct and high speed transportation between their source of raw materials, their factories, and their markets. Many of these locations will have abundant local labor and will enable industries to acquire spacious tracts for future easy expansion not normally possible in congested centers which choke so many of the older routes of travel.

Industries already have sensed the advantage of locating on this new "main line" of interstate commerce. A well known Ohio industrial corporation has acquired a site to establish a new plant along the Turnpike. Why did the company choose that location? An official of the company told the Department of Commerce that the spot had "two definite advantages for our company — transportation and advertising."

It is my opinion that as more and more states build links joining our Turnpike, Pennsylvania will get more and more branches of plants of those States. That is especially true as western states build extensions to America's new "Main Street," because it will enable those companies to produce here, close to the rich eastern market and close to our port for export, and at the same time permit fast and direct communication with the main plant.

The Turnpike, I feel confident, will greatly increase the tourist and vacation travel in Pennsylvania, a business now approaching $700,000,000 in this State.

The Turnpike is a major tourist attraction in its own right. It has captured the imagination of the people of the country. In three cases out of four, when a stranger learns he is speaking to a Pennsylvanian his first question is about the Turnpike. Its easy grades have overcome the fears of driving Pennsylvania mountains formerly held by some Mid-West motorists accustomed to the flat roads and long sight distances of the prairie country. Others have been intrigued by driving under mountains instead of over them. The possibility of skimming along at his favorite speed hour after hour over the most modern of superhighways with no red lights, stop signs, intersections at grade or pedestrian crossings, also is a delight to the motorist tired of the constant stop-go of ordinary driving. All of these are reasons why the Turnpike has become a magnet drawing tourists to Pennsylvania.

Traveling the new Turnpike, hundreds of thousands of tourists inevitably will find their way to the national shrines and historical spots which abound in Pennsylvania. The Fort Pitt blockhouse, Bushy Run battlefield, the Battlefield of Gettysburg, Valley Forge, Independence Hall, all of these and many other spots rich in history or tradition are within minutes of Turnpike interchanges.

As additional states annex their superhighways to our Turnpike, our tourist trade should tend to increase. There are two good reasons for this. One is that motorists, becoming accustomed to their own express roads, will become increasingly curious to see the unusual sight of a continuation of their road burrowing through the famous Pennsylvania mountains. That sight rank as one of the modern wonders of the world. The second reason is that with connecting throughways, Pennsylvania's shrines and famous vacationlands will be within easier reach of distant travelers who in the past have not had adequate time to visit our State because the trip would have had to be made over the slower conventional-type roads and through congested towns.

Consequently, I am in favor of expanding our Turnpike into a real interstate network of super-highways. That will bring us even more industries, more tourists, and more business for the Port of Philadelphia and, of course, employment for more Pennsylvanians. Completing the Turnpike from the Delaware River to the Ohio border will contribute substantially to each of these objectives, but the easier we make it for people of other states to get into Pennsylvania, the faster we will grow.

From the standpoint of the growth and prosperity of Pennsylvania's commerce and industry, I think the extension of the Turnpike across the entire state is one of the most important pioneering developments ever taken in this Commonwealth; but I think Pennsylvania's potentialities for growth and development will expand every time another state adds a link to the Turnpike.

Highway Yardstick—For Peace and War

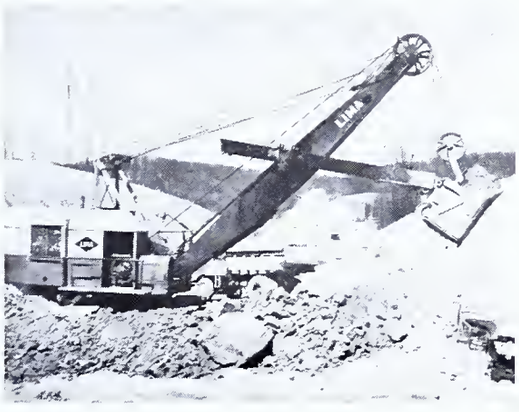
(Continued from Page 37)

time per trip, and with the manpower situation what it was during the war, that was no small saving. It was saving each truck an average of 12 gallons of gasoline per trip—another critical contribution to the immense war effort. It was enabling some truck fleet operators who used the facility to make two extra trips per month, thus reducing the quantity of steel and other materials that had to be diverted from war channels to make extra truck units to carry the war-needed loads.

(Cotninued on Page 172)

Section
27B

Contract
No. 212



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Johnstown
Pennsylvania

Consulting Engineers in Turnpike Construction

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be determined. Frequently, bond price is fixed by statute, but in the case of the Pennsylvania Turnpike, where price of bonds was not established by the basic legislation, general market conditions, together with the knowledge, experience and ability of the underwriting group, governed the price. Therefore, the prospectus, or bond circular used for the distribution of Pennsylvania Turnpike Revenue Bonds, in addition to its legal and engineering aspects as developed by bond counsel, consulting engineers and traffic engineers, contained the price and coupon rates of bonds, based upon the knowledge of the underwriting group of the money market conditions existing at the time of the issue. Then, of course, came the actual marketing of the securities, which was the objective toward which the Financing Functions were directed.

The fifth cardinal function, that of Construction, is frequently considered to be the ultimate objective. Construction actually can be successfully accomplished solely through the fullest cooperation between the engineers and the contractors. The preparation of contract plans and specifications and the engineering supervision of construction, although being definitely Engineering Functions, must be considered as parts of construction. The award of construction contracts is an Administrative Function and, of course, the provisions of construction contracts dealing with the legal phases of construction come under the jurisdiction of the legal staff of the Pennsylvania Turnpike Commission and is considered a Legal Function. In the case of the Eastern and Western Extensions of the Pennsylvania Turnpike, the preparation of contract plans and specifications and portions of the preliminary engineering work were duties assigned to private engineering groups, which were selected by the Pennsylvania Turnpike Commission, and to the engineering organization of the Pennsylvania Turnpike Commission, headed by its Chief Engineer. The engineering work of coordinating, standardizing and unifying the services performed by all these separate engineering organizations has been the responsibility of the consulting engineers for the Pennsylvania Turnpike Commission. This work has included the checking of all contract plans and specifications prepared by others and the general supervision of construction. In this way, the consulting engineers are enabled to properly approve and certify all requisitions drawn by the Commission on the Construction Funds, since it is encumbent upon the consulting engineers to certify all requisitions for the payment of all project costs.

The Pennsylvania Turnpike Commission has been notably fortunate in the caliber of construction contractors to whom the construction work on both Extensions was awarded. Much of the work is far ahead of schedule and although the exigencies of construction, coupled with an abnormal amount of rain during the months of March, April and May, 1950, have combined to retard the progress of a few of the construction contractors, at this writing it appears that the Eastern Extension will be opened to traffic ahead of schedule in October, 1950.

Although it is the popular conception that when the actual work of construction has been completed the ultimate objective has been attained, nevertheless there is a sixth and final function involved in the development of the Pennsylvania Turnpike System, namely its Maintenance and Operation. All of the engineering and construction work involved since the inception of the original Pennsylvania Turnpike in 1937 has been directed toward the achievement of that end — its successful maintenance and operation. This function has been and will continue to be performed by the Pennsylvania Turnpike Commission itself, and the Commission has covenanted

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Financing the Pennsylvania Turnpike System

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with the financing and construction of the Philadelphia Extension while further engineering studies looking toward construction of the Western Extension were undertaken. Provision in the Trust Indenture was made accordingly for the financing of the Western Extension as soon as certain conditions could be met. These conditions in the main had to do with ratios of estimated earnings to revenue, construction costs, and more particularly with the sufficiency of proceeds of the Philadelphia Extension financing for construction of that Extension. In other words, in addition to the usual debt service-earnings ratio requirements, it was felt highly important that the Western Extension financing not be undertaken until such time as the engineers could state unequivocally that the Philadelphia Extension could be completed without resorting to additional borrowing for that purpose. That they were able to do this is, of course, now known, and the Western Extension financing was accomplished promptly once the Commission approved the various engineering studies and estimates. The 1948 financing for the refunding of the 1946 bonds and construction of the Philadelphia Extension aggregated $134 million and the 1949 financing for construction of the Western Extension amounted to $77,500,000.

5. Some Legal Aspects of The Financing Program

To assure the legality of all actions taken by the Commission in adopting the financing program, some of the finest legal talent in the financial world was employed. The firms of Mitchell and Pershing of New York City; Townsend, Elliott and Munson of Philadelphia; and Reed, Smith, Shaw and McClay of Pittsburgh were retained. The Trustee, the Fidelity - Philadelphia Trust Company, was represented by its counsel, Morgan, Lewis and Bockius, and the Turnpike Commission by its very able General Counsel, the late John D. Faller. Like service was rendered in connection with the 1949 financing of the Western Extension by Theodore S. Paul, Esq., who succeeded Mr. Faller.

While naturally there are a great many points on which the advice and assistance of legal counsel are essential in a program of this importance and magnitude, only two need be mentioned here. These are the "Trust Indenture" and the "Official Statement."

The Trust Indenture has been mentioned a number of times in this article but perhaps a little elaboration is in order. This instrument is the "book of rules" under which the Commission operates financially as long as the bonds are outstanding. It sets forth in detail the rights and duties of the Commission and the bondholders as well as the Trustee, Principal Underwriters, and all others who have to do with the finances of the Commission. Its importance cannot be overemphasized for it spells out the security afforded by the bonds. It is examined thoroughly and critieally by experienced investors such as insurance companies and others who maintain staffs of specialists to pass judgment on securities for portfolio investment. In setting up a Trust Indenture it is of course essential that its provisions be sufficiently strict to assure the purchaser of the bonds that all reasonable safeguards are present and at the same time not hamstring the Commission. It should contain sufficient flexibility to assure efficient operation of the facility and permit planning for future additions and betterments. The Trust Indenture drawn in connection with the Pennsylvania Turnpike financing in 1948 accomplished these objections. It gave the investor every assurance that his investment would be amply protected and at the same time permitted the Commission to proceed with the planning and subsequent financing in 1949 of the Western Extension. It likewise made provision for even further additions should such be undertaken in the future.

The "Official Statement", similar to the "prospectus" in corporate finance, is a lengthy presentation of facts and figures approved by the Commission and signed by its chairman. It contains a recitation of legislation, history, plans, limitations, revenues and costs of operation both past and estimated for the future, a summary of Trust Indenture provisions, and many other data. It also contains as supplements, statements of the consulting and traffic engineers covering various phases of the construction, physical condition and operating costs, and revenues of the Turnpike. Every holder of Turnpike securities should possess a copy of the Official Statement.

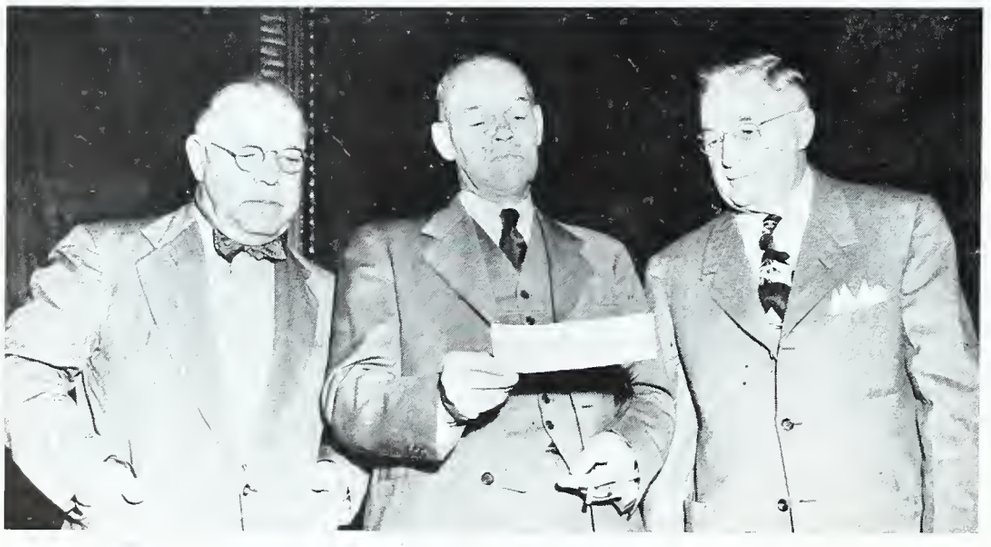
Any reference to the preparation of the two foregoing instruments would not be complete without commenting on the importance of the engineers not only in this but also in connection with many other phases of the financing. Generally thought of as specialists entirely apart from financing, the engineers are invaluable in setting up a financing program. Both the consulting engineers, the J. E. Greiner Company, and the traffie engineers, Parsons, Brinckerhoff, Hall and Macdonald, worked hand in hand with the Commission, the Bankers and the attorneys in setting up the program. They were present at all conferences (which were many and long) and gave unstintingly of their time in other ways to assure the success of the huge financing.

6. Distribution of Turnpike Securities

Having created on paper the Turnpike Extensions and the bonds with which to finanee their eonstruetion, it remained to develop a market in faet for the seeurities created in theory. The ehild had been born and reared to that point where it was necessary to take him by the hand and show him to the world so that he might be aceepted and permitted to take his place in "investment bond society." To aeeomplish this, four primary steps were taken.

The first step was the organization of an underwriting and distributing group. For purpose of elarifieation, "underwriting group" as used here is a group of investment banking firms who take commitment in securities for subsequent distribution. In this instance, the group purchased and owned the Turnpike bonds before resale to the bond buying public. Thus, the Commission was assured of receiving funds necessary for

(Continued on Page 165)



James F. Torrance, Secretary - Treasurer, Pennsylvania Turnpike Commission examining check covering $77.500.000 bond issue with Edward N. Jones, member of the Commission (left) and Thomas J. Evans, Chairman (right) looking on.

Financing the Pennsylvania Turnpike System

(Continued from Page 160)

the project regardless of market variations in the interim. Because of the large size of the bond issues ($134 million in 1948 and $77½ million in 1949), a large group was carefully assembled by the Principal Underwriters with an eye toward both underwriting strength and distributing ability. The group consisted of over 200 investment banking firms located in all parts of the country and insured that *wide* distribution of securities so important from a public relations point of view to business, whether private or public.

The second important step was selling "key investors". In distributing large issues of securities it frequently is desirable that a number of large buyers such as insurance companies, funds, etc., approve the security. Not only does this result in the placement of a substantial amount of the issue but because such buyers with their expert staffs make exhaustive independent investigations, their approval is sometimes the green light for other buyers. In approaching this step, a number of the major companies and funds were solicited by the Principal Underwriters. The studies by these "key investors" over a period of several weeks resulted in most instances in approval of the security and confirmed the judgment of the Principal Underwriters that the issue of bonds just created could be marketed on terms favorable to the Commission.

The third step was that of general education. This involved a number of activities. A meeting was held in New York City in the Great Hall of the Chamber of Commerce of the State of New York, attended by well over 300 people. These people consisted of underwriters and their sales staffs, rating agency personnel, potential investors from various institutions, and many others. Chairman Evans and members of the Commission and the staff, together with engineers, bond counsel, the Trustee, and the Principal Underwriters, gave informative talks and answered all questions. Newspaper and other publicity was arranged. Rating agencies were visited so that they could be fully informed in presenting their analysis of the security to their subscribers. The Commission sent its magnificent panoramic display to New York where it was installed in ground floor space near the heart of the financial district and visited by hundreds of people in the week or so that it remained there. All in all, by the time the refunding and Philadelphia Extension financing reached the market in August 1948, its immediate success attested to the thorough ground work done over the preceding months.

By reason of the spade work done in 1948, the Western Extension bond issue brought to market the following year required less intensive preparation, and its success was to a large extent the result of carefully shaping the issue to the needs of the Commission and to the appetite of the market at the time. The Term 3 1/4% bonds of 1948, offered to the public in early August of that year at a price of 101, subsequently traded in the secondary market as high as 110 and as this article is written they are quoted 105 3/4 bid. The Serial 2 1/4% bonds of the same issue also have been in demand at substantial premiums over issue price. The Term 2.90% bonds issued late in September 1949 at a price of par subsequently traded at seven points above issue price and as of this writing are quoted 104 1/2 bid. The 2 1/2% bonds issued in 1946 for which funds (invested in U. S. Government securities) have been escrowed pending their redemption in 1951, trade as high grade short term paper at a yield of less than 1.00%.

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DIRECTORY AND BUYERS' GUIDE

—: Contractors' Equipment :—

SALES ◆ RENTALS ◆ SERVICE ◆ PARTS

INGRAM—Rollers
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DAVEY—Air Compressors
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MULLER—Concrete Mixers

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DIRECTORY AND BUYERS' GUIDE

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—: Steel Flooring :—

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—: Tire Service :—

Hail The Pennsylvania Turnpike — Long May She Serve.

Highway Yardstick—For Peace or War

(Continued from Page 156)

And that record was made only with non-military operation considered. Open at all time to military vehicles, either separately or traveling in convoys, the Turnpike meant even greater highway mobility than the records can ever reveal.

But as important a role as it may have played in war, the contribution of the Turnpike in peacetime is equally significant. Its users chalk up large savings in gasoline use, in vehicle wear and tear, in accidents that don't happen because of the engineered safety features built into the roadway and lack of crossroads or intersecting traffic.

The Pennsylvania Turnpike, serving as it does as a highway "show case," has another peacetime service in the amount of interest it has generated in highways. Motorists in every state in the nation know about the Turnpike and just how good the good highways they desire can be. It has led to more highway comparisons and to more thinking in terms of "If they can do it, so can we" than can be measured. When it is compared with a stretch of road in almost any state by untold thousands, the motorist immediately starts trying to learn why the roads in his state aren't better.

That stimulation in interest, expressed again and again, and the silent figures

(Continued on Page 174)

Classified Directory

The following is a tentative list of manufacturers, producers and distributors of construction materials, able to furnish products for use in Pennsylvania highway maintenance and construction. This list is subject to change in subsequent issues.

We suggest that when in the market for any of the following materials, you give **HIGHWAY BUILDER** Advertisers first consideration.

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Mexican Petr. Corp., New York, N.Y.
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Seaboard Asphalt Co., Baltimore, Md.
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U.S. Pipe & Fdry. Co., Philadelphia, Pa.
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MARYLAND STATE
G. E. SENSABAUGH, INC., CUMBERLAND, MD., Quarry, 3 Mi. S. E. Cumberland, Md.

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Armco Drainage Prods. Co., Middletown, Ohio
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BARNETT CANVAS GOODS CO., PHILADELPHIA, PA.
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New Haven Quilt Co., New Haven, Conn.
Palmer Bros. Co., New London, Conn.
Service Supply Corp., Philadelphia, Pa.
Sussman Brothers, Pittsburgh, Pa.
Western Felt Works, Chicago, Ill.

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H. E. FLETCHER CO., W. CHELMSFORD, MASS.

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Phila. Expansion Bolt Co., Philadelphia, Pa.
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Taylor-Davis, Inc., Philadelphia 27, Pa.

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Coplay Cement Mfg. Co., Coplay, Pa.
Federal P. Cement Co., Buffalo, N.Y.
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Green Bag Cement Co., Pittsburgh 19, Pa.
Hercules Cement Corp., Philadelphia 2, Pa.
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Lawrence P. Cement Co., Philadelphia, a.
Lehigh P. Cement Co., Allentown, Pa.
Lone Star Cement Corp., Bethlehem, Pa.
Medusa P. Cement Co., York, Pa.
National P. Cement Co., Philadelphia 9, Pa.
Nazareth Cement Co., Nazareth, Pa.
North American Cement Corp., New York, N.Y.
Penn-Dixie Cement Corp., New York 17, N.Y.
Pbgh. Plate Glass Co., Pittsburgh 13, Pa.
Standard P. Cement Co., Cleveland 14, Ohio
Univ-Atlas Cement Co., New York 17, N.Y.
Whitehall P. Cement Co., Philadelphia 9, Pa.

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Central Paper Co., Muskegon, Mich.
Morris Paper Co., Pittsburgh, Pa.
Phoenix Sale Co., Philadelphia 44, Pa.
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The Rick Kraft Co., Chicago 1, Ill.
The Rubberoid Co., Mills, Mass.
Safepack Mills, New York 17, N.Y.
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Bond Crown Cork & Seal Co., Wilmington, Del.
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American Steel & Wire Co., Philadelphia 3, Pa.
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Taylor-Davis, Inc., Philadelphia, Pa.
The Lind Company, Pittsburgh, Pa.
Truscon Steel Co., Youngstown, Ohio
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Robinson Clay Prods. Co., New York, N.Y.
Universal Sewer Pipe Co., Cleveland, Ohio
Secor and Company, Baltimore, Md.

(Continued on Page 174)

Classified Directory

VITR. DRAIN TILE & CLAY PIPE

American Vitr. Prods. Co., Cleveland 14, Ohio
BROCKWAY CLAY CO., BROCKWAY, PA.
Bowerston Shale Co., Bowerston, Ohio
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CONTE EQUIP. CORP., PITTSBURGH 21, PA.
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SHAULL EQUIP. & SUPPLY CO., LEMOYNE, PA.
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STEWART EQUIP. CO., HARRISBURG, PA.
UNION WIRE ROPE CORP., KANSAS CITY 3, MO.

Financing The Pennsylvania Turnpike System

(Continued from Page 165)

Conclusion

As stated at the beginning of this article, the Turnpike financing pattern, as well as the engineering, stands as a model for other enterprises. The Bankers are convinced that the Turnpike System has been soundly financed. They further feel that its earning power in relation to its obligations has been so thoroughly demonstrated that bondholders should be well content with their investment. Further, and of equal importance, the Commission is in a position to move in any one of several ways to its advantage in subsequent years. All bonds become callable in June 1951 so that once all reserve funds have been completed the Commission may begin to retire its debt out of excess earning or, markets permitting, refund all debt into lower interest bearing securities. A more distant call date would have delayed this advantage with the resultant possibility of missing an opportunity to effect important economies. Another advantage to the Commission from the program is that the very wide distribution of the bonds resulted in the establishment of a broad secondary market. This, to the Commission, means that should markets for securities of this type weaken to the point where bonds may be purchased in the open market at prices lower than the call price, the Commission may move rapidly to effect this saving. Narrow distribution — placement of all the securities with a few large holders — would of course lessen, if not eliminate, this advantage. Further, the Bankers are confident that this wide distribution has resulted in much greater interest in the Turnpike than would have been the case in a private or narrow placement program. The over 200 investment bankers throughout the United States selling Pennsylvania Turnpike securities made excellent advertising and publicity agents with the result that more people are familiar with and go out of their way to see and ride over the Turnpike than could possibly have been the case otherwise.

This article could not be concluded without a salute of respect from the Bankers to Chairman Evans and others of the Turnpike Commission and its staff. Through all proceedings and negotiations they displayed understanding and eagerness to get the best possible financing program. The Bankers are happy in their confidence that the Commission has just that.

Consulting Engineers in Turnpike Construction

(Continued from page 158)

to provide these services in an efficient, businesslike manner at a minimum of cost. Under the terms of the Trust Indenture, the consulting engineers are required to assist the Commission in the performance of its duties in this respect through engineering supervision of maintenance, and operation and the submission of recommendations for maintenance, repair and operation for each ensuing year, together with an estimate of the amount of money necessary for such purposes. The constantly increasing volume of traffic on the existing 160 miles of Pennsylvania Turnpike from Irwin to Middlesex is in itself conclusive evidence of the manner in which these Functions of Maintenance and Operation have been performed by the Commission.

It seems fitting to comment upon the interest which the Associated Pennsylvania Constructors have maintained continuously over the years in the work of the Pennsylvania Turnpike Commission. It was the writer's privilege to contribute an article for publication in the Dedication Issue, September 1940, of "Highway Builder." The concluding paragraph of that article reads as follows:

> "The future of super-express highways in the United States depends somewhat upon the financial success of the Pennsylvania Turnpike. It forms the initial link in a super-highway system to connect the metropolitan and industrial areas of the eastern seaboard with the industrial areas and the large cities of the central west. Its success or failure will undoubtedly determine the manner in which the remaining links of such a super-highway system can be financed. The construction of the entire system in the near future must be conceded to be inevitable."

That paragraph might be considered prophetic. The fact that the Eastern and Western Extensions are so near completion is undoubtedly evidence that the existing Turnpike is deemed a success. Although the interpretation of the phase "in the near future," as contained in the above-quoted paragraph, may be subject to question, nevertheless the Pennsylvania Turnpike Extensions are among the earliest and most important of the post-war projects in this Country.

Highway Yardstick—For Peace or War

Continued on Page (172)

of Turnpike use that provide unquestionable testimony that the motorist wants good roads and is willing to pay for them, will bear fruit once it becomes obvious to the nation's lawmakers.

In the meantime, the comparisons are bringing forcefully to the attention of motorists the financial and fiscal policies and conditions which have failed to permit, since 1930, parallel development of our highways and automotive use. That is a healthy situation, because any wise person, having once learned the mistakes which led him to fall into an abyss, can usually be counted upon not to commit the same mistakes again nor to let them be committed against himself.

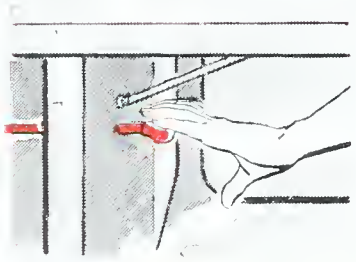
The judgment of the public has been expressed eloquently through the growing use that has been made of the Pennsylvania Turnpike. The eastern extension of this important thoroughfare, together with the building of the new western segment, reflect the attitude of the public toward the future.

The turnpike offers lessons we should be quick to learn. While the highway industry and the engineering profession owe much to the original Pennsylvania experiment, the general public owes even more. For this "dream" highway has produced dividends for the public, in peace and in war, proving on a large scale how critical an item a good highway is.

And in a nation upholding one of the ideologies clashing today in a cold war that might at any time become "hot," the lesson is one which the American people cannot afford to ignore. The extensions of this vital highway will reinforce that lesson in the years that lie ahead.

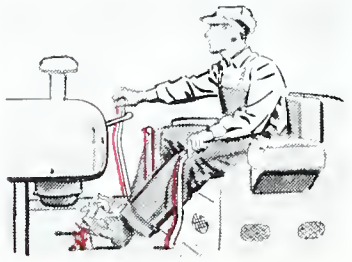
Index Of Advertisers

CHAMPION
the NEW

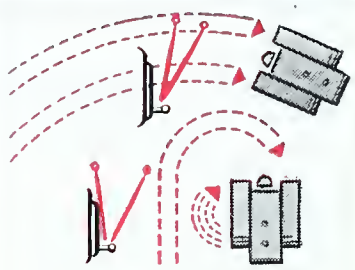


Positive all-weather starting on gasoline, with quick change-over to full diesel operation, all from the seat.

Instant speed change up or down one speed, or stop, without declutching. Planet Power drive does it!



Separate reverse lever for quick change of direction. The tractor moves in the direction the lever is moved.



Planet Power steering puts turns with power on both tracks, feathered turns and pivot turns at your fingertips.

HERE ARE SOME OF THE CHAMPION'S EXCLUSIVE FEATURES

Self load and run with scrapers of 17-yard capacity—and shift gears on-the-go with the rolling load

Cut waste shifting time out of work cycles; provide the best speed for every operation, 8 speeds in each direction!

Work on grades up to 100%. Its power, ground contact, balance and lubrication are right for licking any grade.

Handle heaviest loads on gradual turns as easily as straightaway because both tracks are powered in the turn!

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"There Is Nothing Like The TD-24. It Can Out-Push Any Tractor On The Job."

"Here is the Champion of Crawlers," owners will tell you, "the tractor that will pull down your dirt moving costs."

Contractors and operators who have observed or operated the new International TD-24 diesel crawler are spreading the news. Here is a tractor that out-works and out-performs every other crawler known to the industry!

Operators compete with each other from Florida to Alaska to get "the big red devils," the TD-24's, assigned to them. They'll tell you no other tractor can compare with the TD-24 for ease of operation or work capacity!

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INTERNATIONAL TD-24

Comfortable to ride, powerful, fast, safe and economical to operate, the TD-24 is revolutionizing ideas of what crawler tractors can or cannot do on the big jobs.

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Ingersoll-Rand 105 cubic foot, Waukesha gasoline power, on two rubber tires.

Gardner-Denver 105 cubic foot with air receiver, hose reel, driven by power take-off and mounted on 1941 Ford.

Gardner-Denver air-cooled 105 cubic foot with air receiver, V-belt driven from power take-off and mounted on 1942 Ford chassis with Wood two-yard dump body.

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Gardner-Denver two-stage 160 cubic foot, skid mounted.

Schramm 210 cubic foot with International UD14 diesel on steel wheels.

Worthington 210 cubic foot, two-stage, air-cooled, on steel wheels with Hercules diesel.

Gardner-Denver 315 cubic foot two-stage, skid mounted, Murphy four-cylinder diesel.

Pennsylvania 12"x 10" class 3A single cylinder, 355 cubic foot P.D., flat belt driven 50 HP slip ring motor.

"Worthington two-stage, water-cooled, vertical 250#, 60 CMF, new condition.

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Cedarapids BBB scalping unit.

10x7 Allis-Chalmers Blake type jaw crusher.

1036 Cedarapids jaw crusher. New condition.

#1 Cedarapids Kubit impact breaker.

Cedarapids 42"x 10', 4'x 9' & 4'x 12' screens.

60-ton, 2-compartment, 8' x 18' storage bin with clamshell gates.

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16" x 90' bucket elevator.

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Gasoline, electric or diesel.
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1½ KW to 125 KW, alternating and direct current, gasoline and diesel powered.

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SHOVELS & CRANES

Lorain 75B, 1¼-yd shovel, gas power.

Marion 25-ton diesel powered heavy duty truck crane on heavily reinforced Mack.

P & H Model 625A 15-ton crawler crane.

Brownhoist 1-yd gas shovel and crane.

Lorain 30 combination ½-yd shovel, hoe and clam.

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SHOVEL & CRANE ATTACHMENTS

Lorain 75B-77 1½-yd. shovel attachment rebuilt.
1¼-yd. Lorain 75 shovel attachment complete.
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P & H 203 shovel attachment.
Chain crowd Lorain 30A shovel attachment.
Lorain 40 Hi-Lift shovel attachment.
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50' crane-clam boom, 1¼ or 1½-yd.

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¾-yd. Lorain, 40, LBS#6105, 44", cutting width, teeth, sheave.

27" outside width drop bottom type LBS#1033, good condition.

26" outside width solid bottom type LBS#4377, good condition.

¾-yd. Amsco 40" cutting width, LBS#8101.
Lorain 30 hoe attachment.

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2,000-gal. tanks on semi-trailer mounting.

New and used dump bodies and hoists.

Sterling COE Model 255 GCS Tandem drive, Truc-Tractor, Cummins diesel with 40-ton Rogers low bed equipment trailer, 16—7.50 x 20 tires, air brakes, excellent condition.

BELT CONVEYORS

18"— 24"— 30"— 36"

- "Sealed-for-life idlers
- Lattice or channel frame
- Shipment from stock depending on length

CONCRETE EQUIPMENT

Smith 3½S, 6S, 11S. In stock. New.

27E Koehring paver.

CONCRETE FINISHERS - SPREADERS

Jaeger type "L" double screed, 10½'- 12½', rebuilt.

Heltzel 10'- 12' finisher, rebuilt.

Blaw-Knox gas-electric finisher, 10½'- 12'.

2—Koehring 10'- 16' finisher, rebuilt.

CONCRETE ROAD FORMS

830'—Truscon 7"x 8" forms, with stakes.
1380'—Heltzel 7" x 8" forms, with stakes.
4050'—Heltzel 9" x 8" forms, with stakes.
1430'—Heltzel 10"x 8" forms, with stakes.
1010'—Blaw-Knox 10"x 8" forms, with stakes.

FINE GRADE MACHINES FORMGRADERS

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R.B. Fine Grader for 21' width, rebuilt.

Cleveland formgrader, rebuilt.

Carr formgrader, new 1944, rebuilt.

BARBER-GREENE 44C TRENCHING MACHINE

ROLLERS

Hercules 9-11 ton, three-wheel.

Buffalo-Springfield 10-ton, three-wheel.

Apsco 3-4 ton tandem.

TRACTORS

New and used Minneapolis-Moline pneumatic tired tractors with front end loaders, bulldozer blades, towing winches.

FD Cletrac crawler tractor, Buckeye bulldozer and double drum power control unit, powered by DHXB Hercules diesel engine; rebuilt, immediate delivery.

International TD-9 with Bucyrus-Erie angledozer.

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4 miles of AMERICAN perforated pipe on the Turnpike!

Joyce Brothers crew runs trenchliner, lays American perforated clay pipe for D. W. Winkelman, Inc., on Sections 29B and 29C.

ON THE WESTERN EXTENSION of the Pennsylvania Turnpike, 54 miles of American Vitrified *perforated* clay pipe is being used to provide base underdrainage that will assure longer highway life.

Among the prominent turnpike contractors using American *perforated* pipe are Joyce Brothers Contracting Co., L. S. Wescott, L. G. Defelice & Son, Inc., V. N. Holderman & Sons, Inc., and Ralph Myers Contracting Corp.

An American representative will be glad to discuss your next highway or sewer job with you and to make practical suggestions that may save you time and money.

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AMERICAN VITRIFIED PRODUCTS COMPANY

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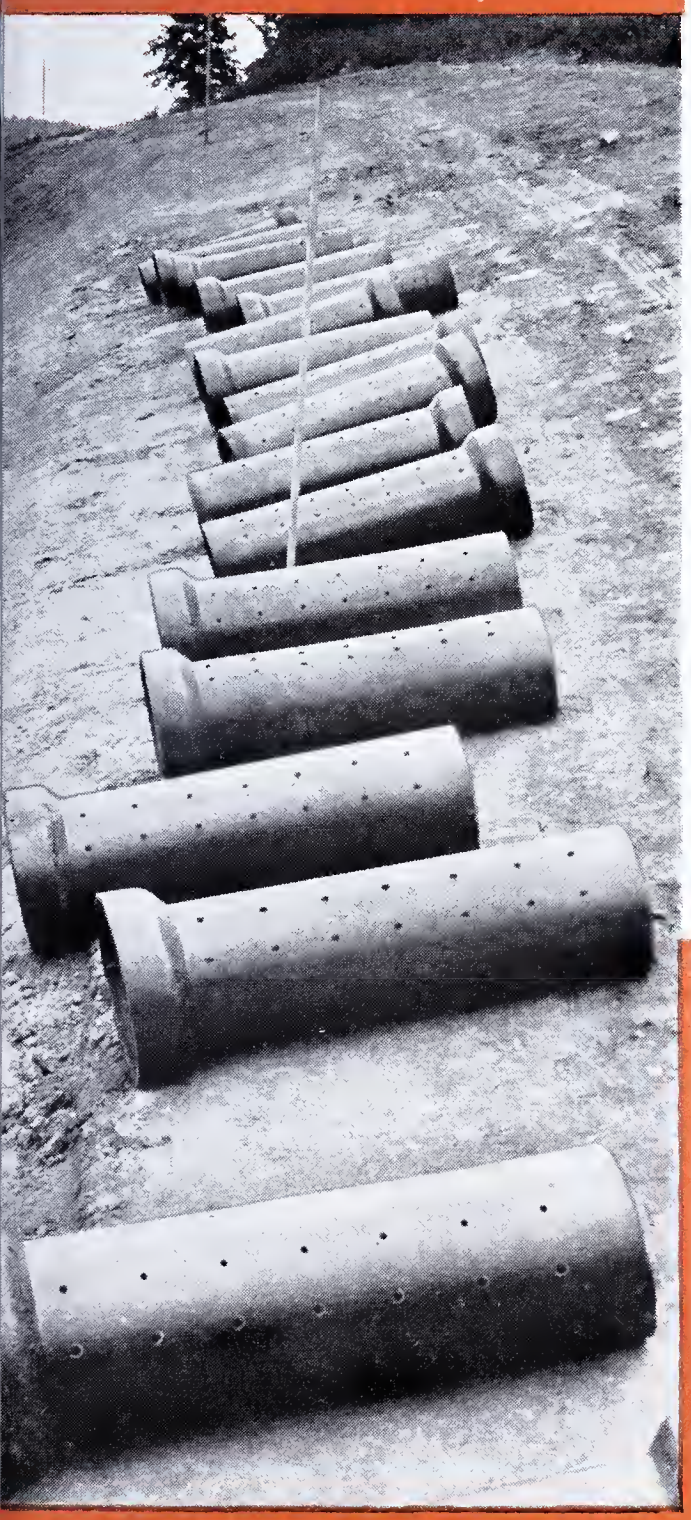
American manufactures Vitrified Clay Sewer Pipe (3" thru 36"), Concrete Sewer and Culvert Pipe (6" thru 120"), Wall Coping, Farm Drain Tile, Vitrified Clay Liner Plates and other clay products.



merican Vitrified pipe ready at installation site along Turnpike . ht of way.

American pipe arrives on the job when wanted. No waiting around. American now gives the fastest service in its history. And American pipe goes in for good! You're sure of proper glaze, quality clay, permanent protection from acids and corrosive chemicals. Top contractors rely on its proved performance.

Safety Features of Construction on Philadelphia Extension of Pennsylvania Turnpike

(Continued from Page 36)

are constantly in a position to make any changes or eliminations in order to insure a safe operation. In many instances, dangerous conditions were removed or corrected by the supervisors without any suggestions on the part of the Safety Engineers. In the event that an urgent safety recommendation met with a non-compliance, the Safety Department had recourse to a standard safety order which not only cited the particular hazard, but also provided for remedial action by quoting the particular law, rule or regulation involved. Copies were sent to the contractor, Chief Engineer, Resident Engineer and Safety Engineer, while the fifth copy was retained in the Assistant Safety Engineer's files. Compliance was generally had upon the issuance of the safety order, but in the event of a continued non-compliance, the Safety Enginer brought the matter to the attention of the Chief Engineer, upon whose decision the final disposition of the case would rest. Due to the excellent spirit of cooperation shown by all concerned, few safety orders have been issued, and none as yet have been brought to the attention of the Chief Engineer for final decision.

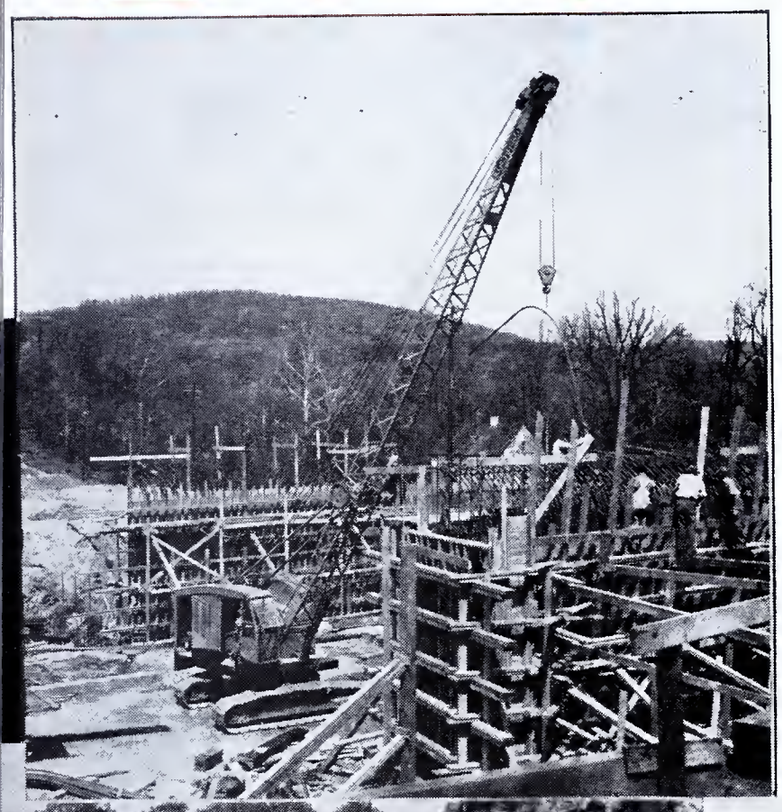
As often as possible, and without interfering with the conduct and progress of the work, short safety meetings were conducted, with even so few as three men present, and when ever it was possible to get a group of men together. Due to the nature and expediency of the work it has been noted that the men were attentive and interested, and in many cases, very pertinent suggestions were made.

Among the special features of the Turnpike construction we found three that were outstanding and required special study: First, the heavy construction equipment, which, because of constant changes and improvements, involved constantly changing hazards due to increased speeds and capacities; Second, the explosives situation, an ever-present source of danger and Third, the type and size of structures required to cross streams, railroads and highways. These three classifications presented practically every hazard of which one might think, and were the cause of much concern on the part of the Safety Department. Another operation, paving, presented some very unusual hazards due to the high speed of the batch trucks supplying the paving machines. Separate from all of the above is the human element, the most prolific source of accidents. It was found that the majority of the accidents were traceable to lack of knowledge, inattention to and diregard for rules and regulations, and an almost complete thoughtlessness for the safety of others. Studies of the accident reports brought out these facts with startling clarity and shows the need for a more intensive safety education of heavy construction workers.

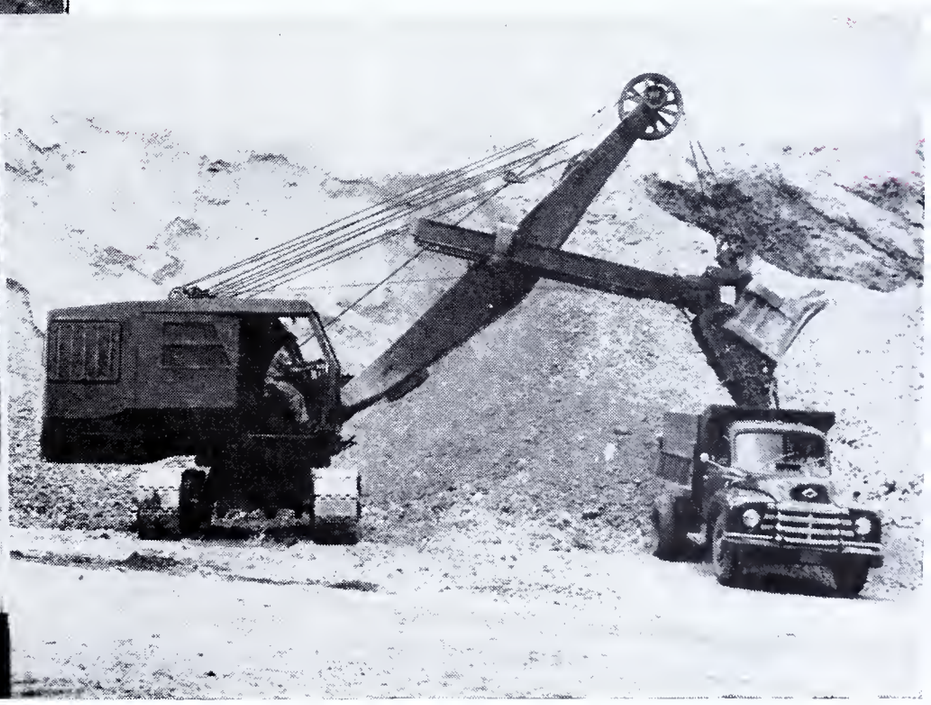
As accidents occurred, the injured worker was immediately given emergency first aid, and taken to a doctor or hospital as quickly as possible. Each contractor furnished the Safety Department with a copy of the accident report, from which the accident frequency and severity records were compiled. In the case of serious or fatal accidents, a report was immediately telephoned to the Central Office and an investigation was promptly instituted, followed by recommendations for the prevention of a recurrence of such an accident, together with a detailed report to the Chief Engineer.

Due to the complete cooperation of all concerned, an exceptionally fine safety record has been maintained. The Safety Department wishes to take this opportunity to thank the Commission, Engineering and Construction Departments of the Commission, Department of Labor and Industry, Department of Health, Department of Highways, contractors and workmen for helping to make this huge undertaking one of the safest of its kind.

SHOVELS *are our* BUSINESS!



. . . When shovel, crane and dragline work is in the picture check with your **shovel specialists**, Capitol Equipment Co.! Complete lines of tested and proven Koehring equipment with all the anxiliary lines necessary for profitable shovel operation —parts and service as close as your telephone. . . KOEHRING equipment from CAPITOL has been hard at work on the Turnpike. . . . **At left** is the Koehring Model 304, working for the Conestoga Construction Co., shown setting steel for bridge work on section 204 . . . **Lower left** is the Koehring Model 605, with 1½ yd. bucket, working for Fry Coal & Stone Co. in their quarry at New Cumberland crushing stone for Turnpike work. Fry also uses 4 Koehring DUMPTORS to work with their shovel . . . **Below** is a Koehring Model 604, recently re-built by Capitol for the Wernersville Lime and Stone Co. Shown loading slag near Robesonia for use on the C. W. Good Turnpike contract.



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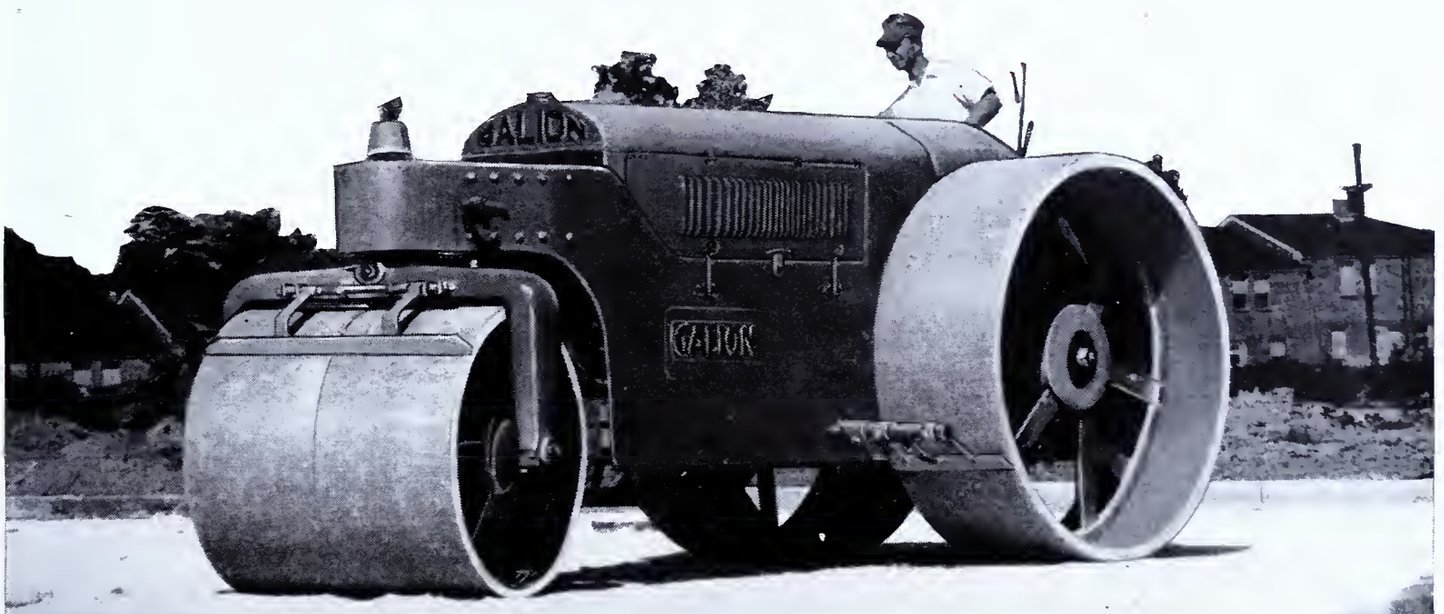

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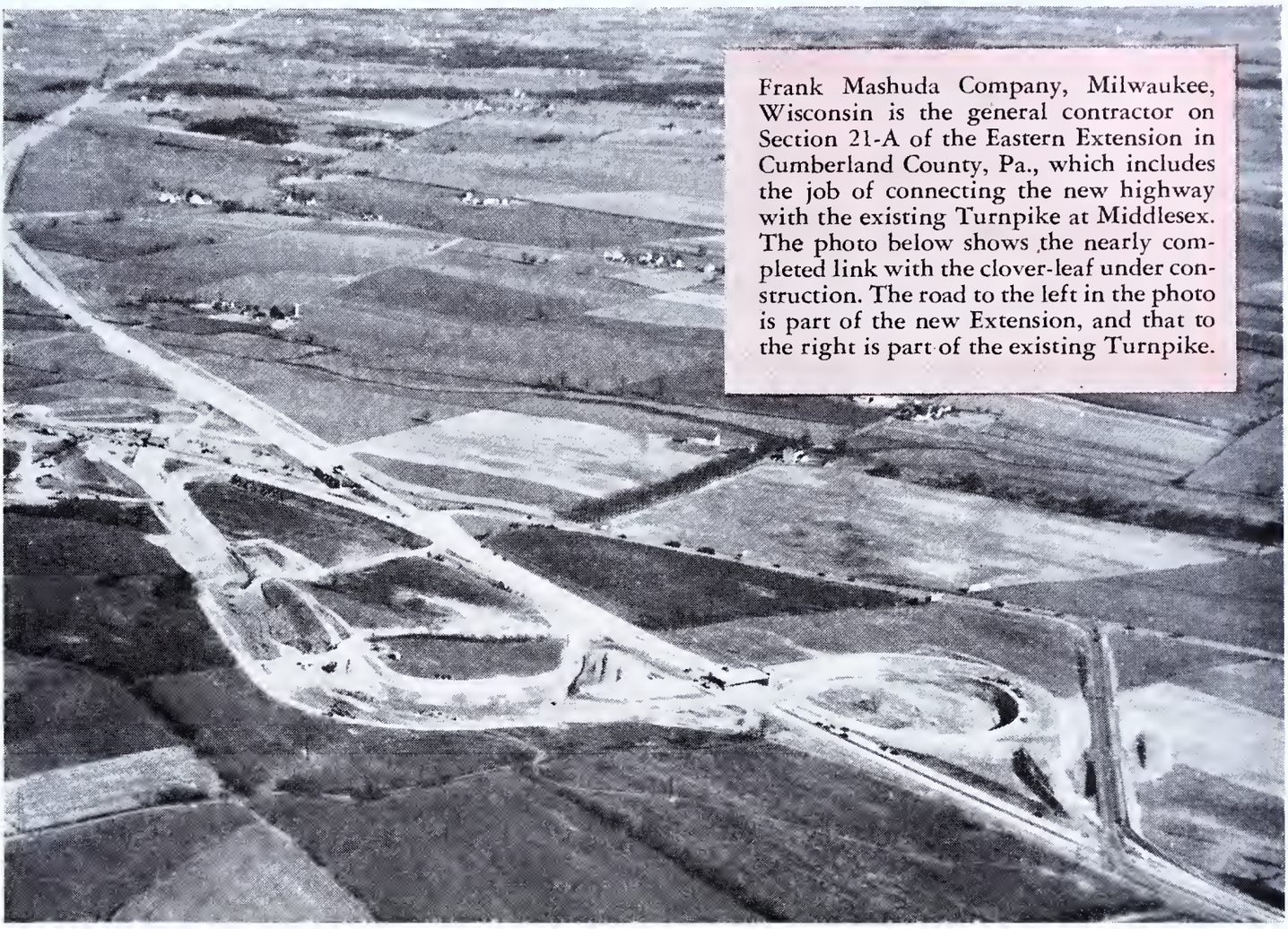

Frank Mashuda Company, Milwaukee, Wisconsin is the general contractor on Section 21-A of the Eastern Extension in Cumberland County, Pa., which includes the job of connecting the new highway with the existing Turnpike at Middlesex. The photo below shows the nearly completed link with the clover-leaf under construction. The road to the left in the photo is part of the new Extension, and that to the right is part of the existing Turnpike.

FRANK MASHUDA Company is one of a number of leading contractors on the Pennsylvania Turnpike Extension who find that the use of Gulf products is reflected in better operating records for equipment.

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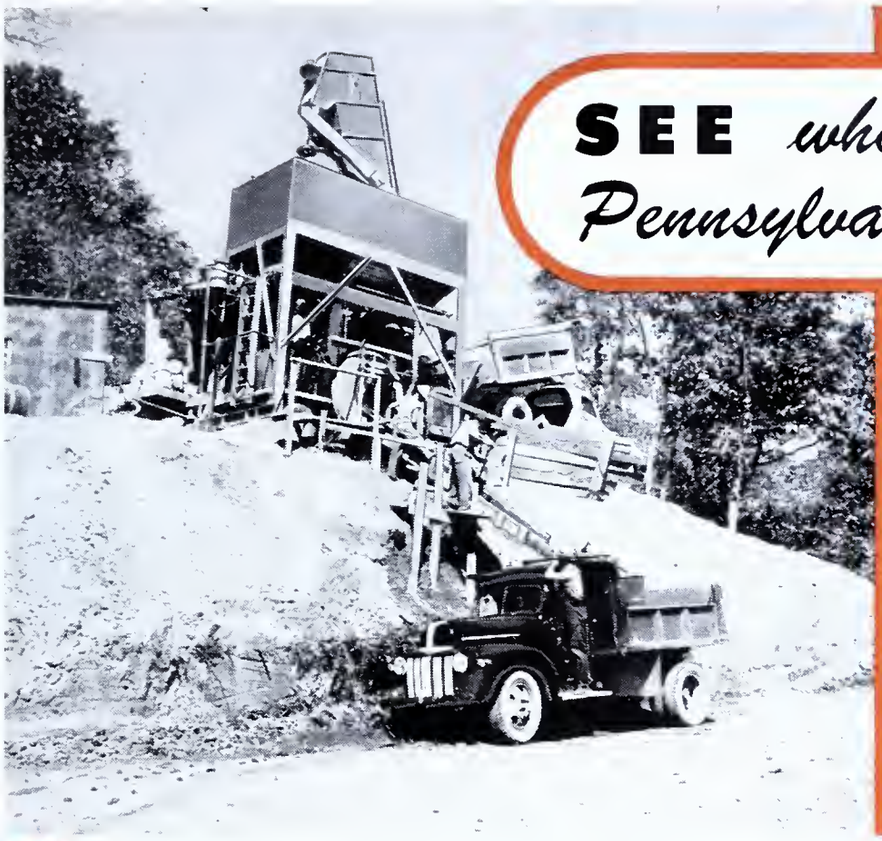
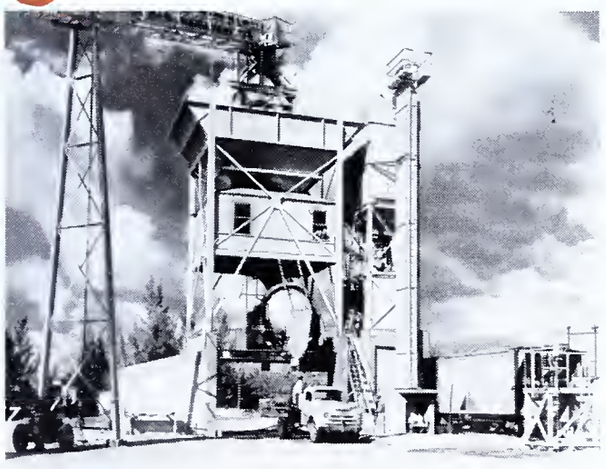


THE Erie Portable Concrete Plant at the left has produded 3275 cu. yds. of air entrained concrete for tunnel and spillway at the Burr Oak Dam sight. This plant features 20 cu. yd., 3 compartment bin loaded by integral 60 T. P. H. bucket elevator with materials batched thru hydraulically controlled 3 beam AggreMeter with 4th beam for water weighing. One man operates all controls, a helper feeds bag cement. Takes about an hour to set up this plant and less to knock down for moving to next job.

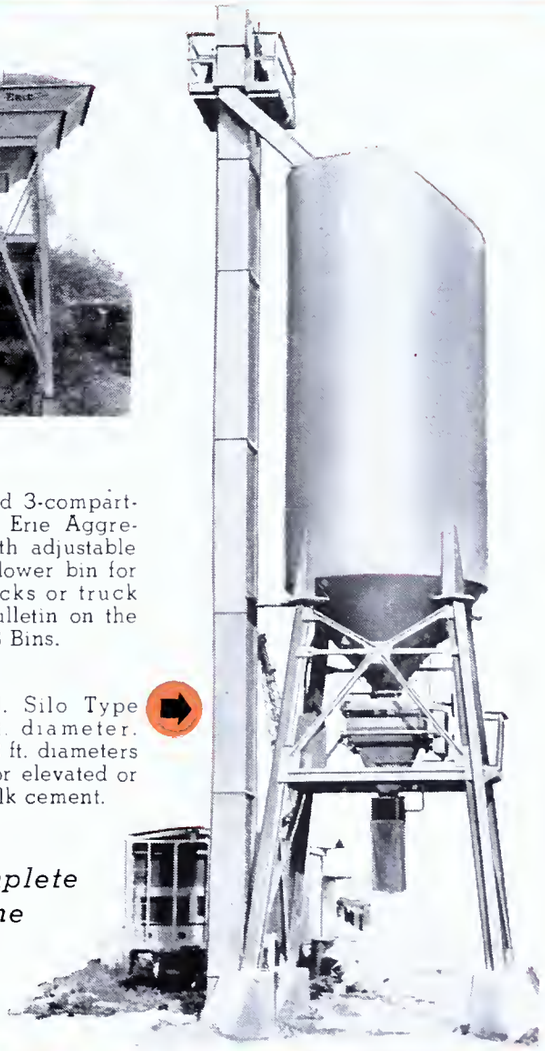
Erie Portable Concrete Plant made 3275 cu. yds. of concrete at Burr Oak Dam in Ohio.



Erie 3 yard Wet and Dry batch Concrete Plant includes Type CTB 160 cu. yds. 3-compartment AggreMeter Plant connected to Erie M-3 492 bbl. single compartment Cement Bin loaded by undertrack hopper to vertical 50 T. P. H. bucket elevator. Produces up to 500 yards of concrete per day.

Erie G. T. B. 79 yard 3-compartment bin with 3 yd. Erie AggreMeter. Equipped with adjustable columns to raise or lower bin for charging batch trucks or truck mixers. Write for bulletin on the complete line of GTB Bins.

Erie CSB 592 bbl. Silo Type Cement Bin, 11 ft. diameter. Available in 11 & 12 ft. diameters in many capacities for elevated or ground storage of bulk cement.



Write for Booklet 2L-2 for complete data on the line of Erie 2-line Contractor Buckets.

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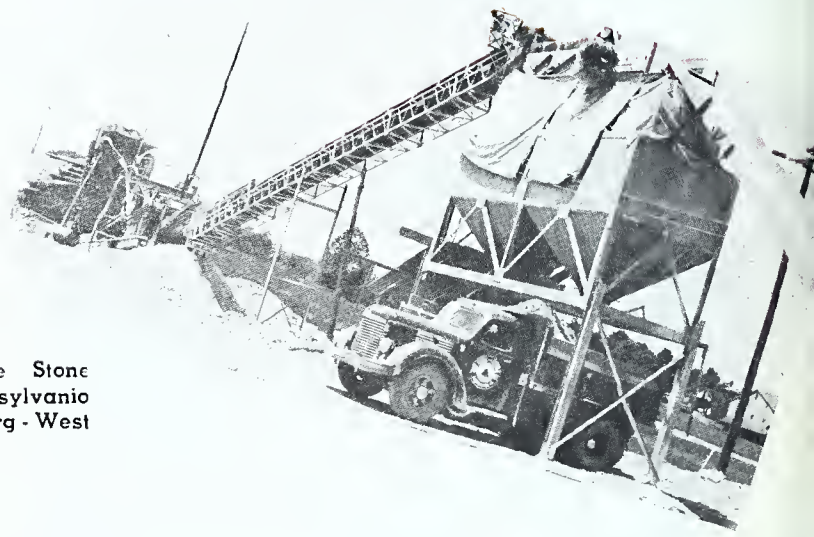

Views of our portable Stone Crushing Plant on Pennsylvania Turnpike near Harrisburg - West Shore Interchange.

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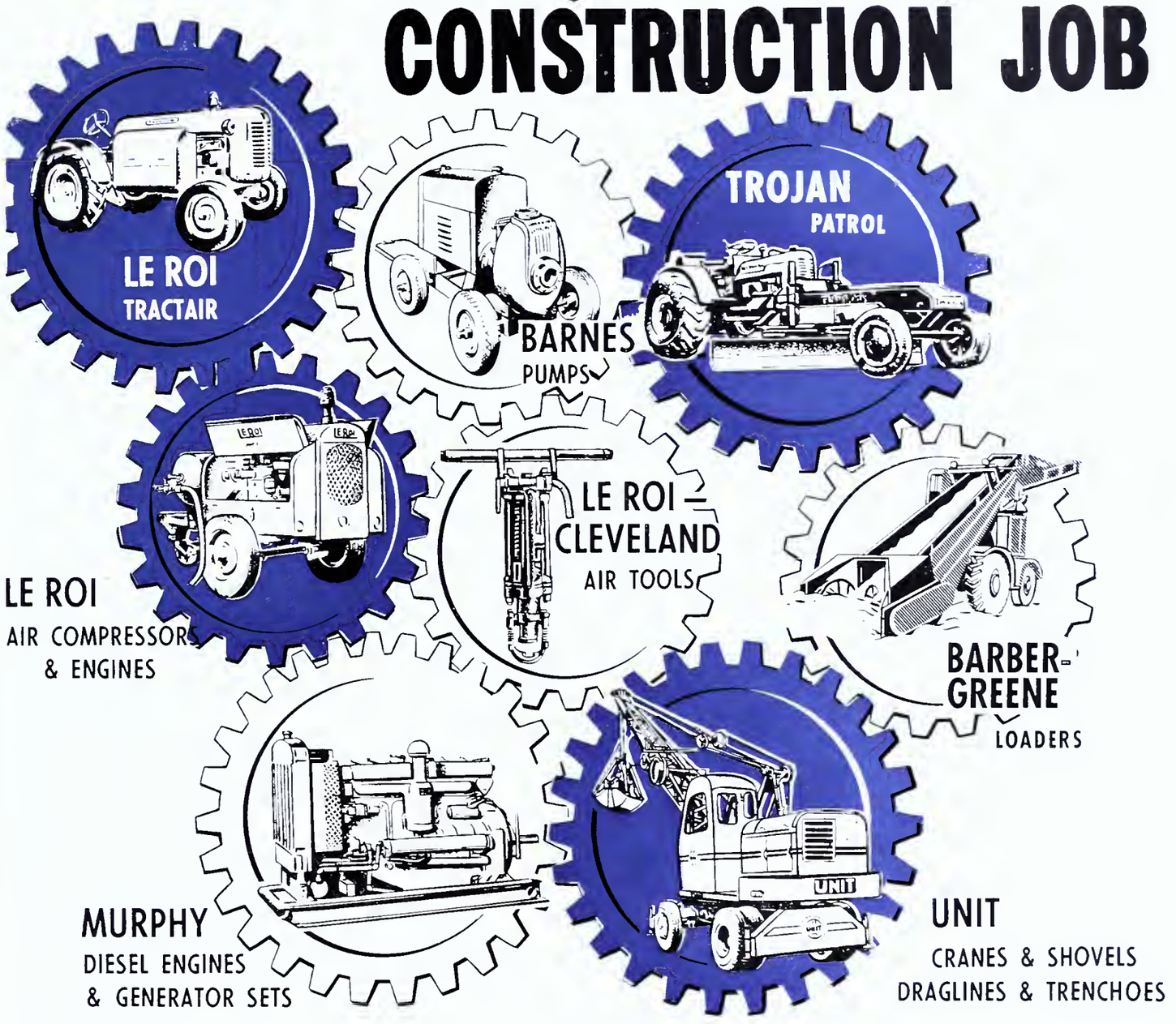

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